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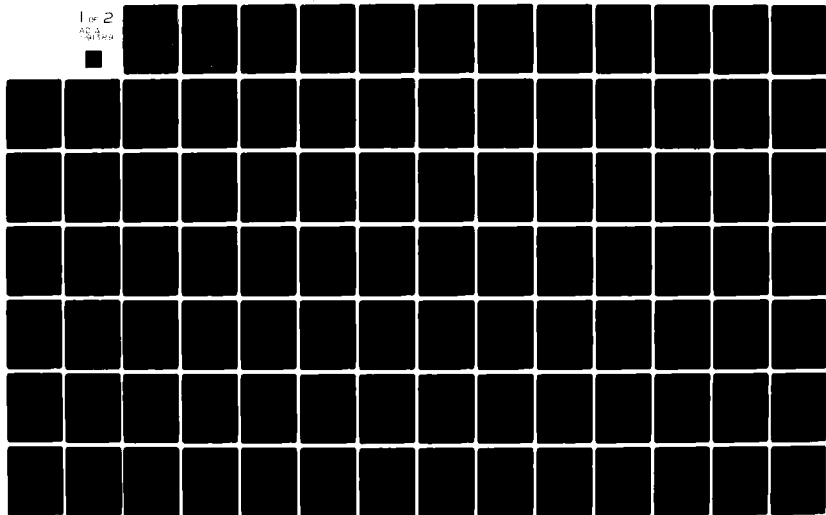DEC 79   J W KOCH
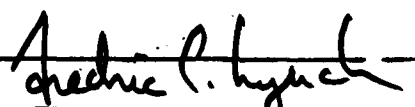UNCLASSIFIED   AFIT-CI-79-243T   NL

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THE EFFECT OF TRIAGE ON PATIENT FLOW

IN AN OUTPATIENT CLINIC

by

John Wallace Koch

An Engineering Report Presented in Partial Fulfillment
of the requirements for the Degree
Master of Science

master's thesis,

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ABSTRACT

An extensive literature search revealed that the use of various types of appointment systems, the use of allied health personnel, and the use of triage, or the priority sorting of patients, are all major methods currently being used to improve patient flow in health care systems. In an effort to determine the effectiveness of the use of triage in improving patient flow in an outpatient clinic, the operation of the general practice clinic at the Williams AFB Hospital was studied. This is a small military facility which was using an impanelment system based on triage in parallel with an individual appointment system at the time of the study. Primarily through the use of patient questionnaires, the two systems were compared on the basis of provider service times, total service times, total number of patients seen, and patient satisfaction. Results of the study showed that although triage patients had lower provider service times (8.55 min. vs. 12.45 min.), their total service times were significantly longer (68.3 min. vs. 37.5 min.). In addition, these long waiting times were shown to significantly affect patient satisfaction with the service at the clinic as a whole. Furthermore, it was discovered that the use of triage in this manner actually decreased the total number of patients seen in the clinic. However, it was proposed that by using medical technicians rather than physician assistants for screening, and by using modified wave scheduling for the triage patients, total service times could be

reduced and the total number of patients seen could be increased

without sacrificing the principle of triage.

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THE EFFECT OF TRIAGE ON PATIENT FLOW

IN AN OUTPATIENT CLINIC

by

John Wallace Koch

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December 1979

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TABLE OF CONTENTS

TABLE OF CONTENTS, CONT.

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

With the increased use of hospital outpatient facilities for primary health care, crowded waiting rooms and long waiting times have come to be expected by the patients involved. Nevertheless, there has been a great deal of research done in the past, beginning with the work of N. T. J. Bailey and J. D. Welch for the Nuffield Hospitals Trust (6, 7, 77, 131), on various methods for improving patient flow through an outpatient clinic. Bailey's work centered primarily around the development of appointment systems, and a great deal of research has been done, and is still being done, in this area. However, there are also other more recent developments for improving both the availability of service and the speed with which it can be obtained. Two primary innovations are the use of allied health personnel to perform some of the duties formerly done only by physicians, and the use of triage, or the priority sorting of patients, to improve the overall flow of patients through an outpatient clinic. Although triage has been used mainly in emergency rooms or walk-in clinics, it has recently begun to be used as a tool for improving services at clinics run on an appointment basis as well. However, there has as yet been very little research done to determine the effectiveness of using triage in this manner.

Recently, a triage system was introduced for use in the general practice clinic of the small military hospital at Williams AFB. The system is run on an appointment basis, and officials at the

hospital were interested in analyzing the effectiveness of the new system. Since the system is being used in parallel with a traditional appointment system, a study of the operation of this clinic afforded an excellent opportunity to compare the relative merits of the two systems.

In this report, general background information on the use of various appointment systems, the use of allied health personnel, and the use of triage will be provided. Following that, a more specific background will be given, explaining the operation of the clinic chosen for this study. The methodology to be used in obtaining data will then be discussed. Next, the results of the study will be presented, followed by recommendations for improving the operation of the clinic. Finally, the contribution of this research, as well as recommended areas for further research, will be discussed.

CHAPTER 2

GENERAL BACKGROUND

Because of ever increasing health care costs, health care
administrators are continually trying to improve and streamline health
care systems. Although their efforts cover the entire range of
activities in these facilities, patient flow is one area that has
received an especially great deal of attention. Rising has described
patient flow as the problem of "...bringing together the...patient and
the appropriate /health care/ providers within the proper environment
(86:4)." The patient flow problem itself can be broken down into
several aspects, including appointment systems, the use of allied
health personnel, and triage. However, these areas all focus on one
main goal: ensuring maximum utilization of the health care provider,
while simultaneously minimizing inconvenience to the patient (86).
This is particularly important in an outpatient setting.

Appointment Systems

Significant research on appointment systems has been conducted
for over 25 years, beginning with the work of N. T. J. Bailey and J. D.
Welch for the Nuffield Provincial Hospitals Trust (6, 7, 77, 131). At
that time the most common appointment system in use was the simple
block system. Since Bailey's work was done, a number of different
types of appointment systems have evolved, including individual
appointment systems, mixed block and individual systems, and more
recently wave and modified wave systems.

The block appointment system is, in practice, no appointment system at all. Mainly used in private practice years ago, the block system has become practically extinct. Perhaps a description of the system can best explain the reasons for this. A doctor, or other provider, schedules certain hours when he will be available for consultation, for example 8:30 to 11:30 AM and 1:00 to 3:00 PM. Patients arrive at their convenience, and are seen on a first come, first served basis. Under this system, waiting times can build up rapidly, especially if patients begin arriving hours before the scheduled start of the day so that they can be at the beginning of the queue. Common traits of this system are extended waiting times and crowded waiting rooms, and these conditions eventually prompted the work done by Bailey and Welch (6, 7, 111).

Bailey was one of the first to develop an individual appointment system. In an individual appointment system, each patient is assigned a specific period of time during which he is to meet with the health care provider. From the provider's point of view, the most important benefit of this system is "...to supply a steady stream of patients so that the provider will not have to wait (86:33)." Just as important is the commitment to the patient "...to secure access to the provider at a convenient time with as little waiting as possible (86:33)." However, these benefits to the patient and provider result not only from the individual appointment system, but also from most other new systems as well. In determining the period of time to be assigned for each appointment, Bailey suggested using the average consultation time:

> It is suggested that each doctor...should ascertain
> his average consultation time for each type of clinic
> he holds. In working this out he should include all
> time spent on consultation, examination, entering up
> case papers, etc.--in short, everything he does for
> the patients. He should exclude time taken up by
> casual interruptions (131:1108).

Use of average service time has since become a standard in the design of appointment systems.

Further efforts to improve appointment systems resulted in the development of a modified block system. Although it also is based on average consultation time, the modified block system applies this principle in a slightly different way. Rather than scheduling each patient for appointment intervals based on the average service time, a number of patients are scheduled for one appointment time, with the length of the appointment being equal to the total service time for the patients. For example, in a clinic with an average service time of 10 minutes, three patients could be scheduled to arrive at each 30 minute interval. The main objective of this system is to ensure that at least one of the patients is available at the scheduled time, and therefore it is used most commonly with two or three patients scheduled for one appointment time. Its effectiveness has been demonstrated by Soriano, who has shown that a two-at-a-time system can reduce waiting times over an individual appointment system by as much as 50% (111:397).

Wave and modified wave systems are a more recent development, and have shown some promise in decreasing waiting times as well as increasing productivity. The basic idea behind these systems is to modify the streams of incoming patients so as to have peaks and

valleys, or "waves," in the schedule, allowing the physicians occasional opportunities to catch up and therefore finish the day approximately on time. Consequently, the main feature of these systems is the method used for scheduling patient arrivals:

> The actual schedule is based on the approximate number of patients a physician can see in an hour's time on the average, how many actual examining rooms are available to the physician, and the importance of not scheduling any patient after the 30- to 40-minute point of the hour. An example would be the schedule of a physician who, on the average, sees approximately five patients an hour and has one examining room available. The first two patients are scheduled on the hour, the third and fourth for 15 minutes after, and the last on the half-hour (134:31-32).

Under this system, the best results are achieved when the more minor illnesses can be scheduled at the beginning of the hour. Although this technique has shown promise in improving patient flow and increasing productivity, it has failed to be widely implemented. As Lane, Schroer, and Willis have all explained, this is most probably due to a failure of physicians to either understand or to properly implement the system, rather than to the structure of the system itself (56, 98, 134).

Although these appointment systems appear in theory to provide for the orderly and efficient flow of patients through the health care system, in reality a number of problems are inevitably associated with all of them. Early or late arrivals, walk-ins, or broken appointments can turn what seemed to be an orderly appointment system into complete chaos. If left unchecked, the system may disintegrate to the point where there is really no system at all. Because patients will not

arrive at precisely their scheduled appointment time, because they may arrive without any appointment at all, and because they will require varying amounts of time and various levels of provider skills for their care, these factors must be considered in the design of an effective appointment system.

Although late arrivals can increase patient waiting time, studies have shown that patients tend to arrive ahead of their scheduled appointment time (77, 100, 131). If these patients are seen at their scheduled time, the only problem arising from the early arrival is that of the increased waiting time which is induced by the patient himself. Health care providers must be careful, however, not to routinely service early arrivals ahead of their scheduled time, especially if they are taken before patients with earlier appointments. This can increase the waiting time for other patients, as well as teach the patient bad habits. One reason appointment systems fail to work as designed is because patients are allowed to circumvent the system. This can occur when patients are not taken in order of their appointment times, as in the case of early or late arrivals. It can also occur if walk-ins are seen ahead of patients who have scheduled appointments, or even if walk-ins are seen in spite of clinic policy which requires every patient to have an appointment. However, these problems can be overcome by actively encouraging patients to be punctual, and by making allowances for walk-in patients.

In dealing with the problem of providing care for walk-in patients or for patients with urgent problems, administrators and others working in these systems need to recognize that, logically,

"Systems that accept walk-in patients and emergencies are inherently more variable, and therefore tend to be less efficient than systems that will accept patients only by appointment (86:7)." Two methods which have been recommended for use in alleviating this problem are the use of a work-in rate in designing a clinic schedule, and the use of an urgent appointment system (14, 134). When using the work-in rate, a number of appointment blocks are not scheduled, based on the expected number of walk-in patients each day. In a similar fashion, appointment blocks are also kept open each day under an urgent appointment system, but these appointments are filled ahead of time on a same day basis. The advantages of the urgent system over the work-in rate are obvious. By scheduling specific appointment times, urgent patients are worked into the appointment system in an orderly fashion, with a much smaller degree of variability in the number of patients that need to be seen on a same day basis.

As mentioned earlier, another problem that can destroy an otherwise orderly appointment system is patients who fail to show up for their appointments. Numerous studies have been done on broken appointments and appointment breakers, on topics ranging from what type of patient tends to break appointments and why, to various methods which can be used to reduce broken appointment rates. These studies have shown broken appointment rates ranging from highs of 11% to 42% being reduced to minimums of from 7% to 9%, primarily through the use of mailed or telephone reminders (3, 4, 20, 30, 36, 37, 50, 51, 58, 65, 74, 85, 97, 102, 105, 106, 119).

One further aspect of appointment systems, as they relate to

the patient flow problem, should be mentioned. A number of studies
have been done on the use of centralized vs. decentralized appointment
systems (19, 53, 68, 80, 108, 120). When patients use hospital or
other outpatient facilities that have more than one clinic or health
care provider, making an appointment with the appropriate provider can
become a problem. A number of calls, to various providers or clinics,
may be required before the patient has secured an appointment with the
provider best able to care for him, in terms of professional knowledge
and skills, availability, and patient desires. Another problem can
result if a patient needs appointments on the same day with more than
one provider, X-rays and a physician for example. In this case
numerous calls, scheduling and rescheduling appointments, may be
necessary before an acceptable combination of appointments is
achieved. By using a centralized appointment system, many of these
problems can be eliminated. In a centralized system, appointment
sheets for all health care providers are located in a single area.
Appointments are made, in most cases by telephone only, by contacting
the appointments area and asking for services needed. The appointments
clerk can then determine the appointment availability of the various
providers, as well as sequence appointments for the various providers.
Because of these advantages, centralized appointment systems seem to
be used almost universally at large health care facilities.

Allied Health Personnel

As a result of recent efforts to help improve patient flow
and to increase physician productivity, the use of allied health

personnel has become increasingly widespread. A major reason for this, as Johnson has stated, is that "The productivity goal of the individual physician should be to utilize the skills that are unique to medicine at their maximum levels for the greatest amount of time consistent with high-quality performance (47:82)." He further indicates that physician productivity can be increased through the use of efficient scheduling procedures and by relieving them from nonprofessional duties. The use of allied health personnel is seen as a major means of more fully utilizing the unique skills of the physician. In addition, another widespread method of relieving physicians from nonprofessional duties is through the use of medical technicians. Although these two professions are related from the standpoint of relieving physicians from certain duties, there is a difference in the types of duties performed by each.

Medical technicians are employed primarily for the purpose of taking vital signs, such as temperature, blood pressure, and respiration, and for assuming other minor duties so that the physician's time can be spent in consulting and examining the patient. Although some specialized training is required, it is relatively minor compared to that of physicians or allied health personnel.

There are a number of titles given to the various types of allied health personnel, and although their degree of training and basic responsibilities are similar, they can be used in a variety of ways. Whether called paramedics, nurse practitioners, nurse clinicians, physician extenders, physician assistants, or MEDEX personnel, their main purpose is to perform duties formerly done only

by physicians, so that more people can be seen safely and efficiently.

The types of duties performed by allied health personnel are numerous, and with widespread acceptance by both physicians and patients, they are continually expanding their capabilities. Generally they are trained for specific areas of responsibility, as pediatric or obstetric nurse practitioners for example, but they can also be used in a general practice setting for the treatment of minor illnesses. In most cases allied health personnel are found in clinics and physicians' offices, working alongside and with easy access to physicians. However, they can be used as independent providers of care. One example of this is the use of paramedics in an outreach program in Peoria, Illinois. This program is considered successful, and has shown a high degree of acceptance by both physicians and the community (76). When working in clinics and physicians' offices, allied health personnel assume a great deal of the workload of the physician. Properly trained personnel can competently treat a great variety of problems with no degradation in the care received by the patient, thus increasing the time the physician can spend treating problems that require his particular expertise.

A large number of studies have been done to determine the effectiveness of allied health personnel both in the treatment of patients and in increasing physician productivity, and also to determine their acceptance by patients and physicians (16, 24, 27, 29, 32, 54, 59, 60, 61, 62, 63, 66, 69, 71, 75, 99, 107, 112, 114, 115, 118, 126, 127). Spector reports that nurse clinicians were effective in providing high quality health care during an evaluation of an

internal medicine clinic (114). Spitzer came to the same conclusion
in a study of nurse practitioners used in a family practice (115),
as did Vickery in an evaluation of the AMOSIST program used by the
US Army (126). In a more quantitative study, Sox reported that in one
clinic a computer audit of patient records revealed that 45% of the
patients treated in the clinic could have been correctly treated by
physician's assistants (112). In another study Komaroff also examined
the use of physician assistants (54). Data analysis showed an 11%
false positive rate, that is, patients being referred to a physician
when they could have been properly cared for by the physician
assistant, and a 1% false negative rate, or patients who were not
referred to a physician when they should have been. Other results
indicated that 37% of the cases were handled without seeing a
physician, and that in 94% of the cases handled by the assistants,
physicians accepted their diagnosis.

The use of allied health personnel can also increase physician
productivity. For example, Garfield reports that in a paramedically
staffed health-care-delivery system, improvements were shown in
physician accessibility, waiting time for new appointments, and
physician time and costs per entry work-up (29). Similarly, Glenn
also reports that productivity can be increased through the use of
allied health personnel (32). In a study done at the Jamestown
Medical Clinic in Virginia, Voltmann examined productivity increases
through the use of nurse-practitioners (127). Physicians there were
able to shift from 50% to 75% of their tasks to the nurse-practitioners.

In other studies done on the use of allied health

personnel, it has been shown to be widely accepted by both physicians and patients. Merenstein reports a high degree of acceptance of the nurse practitioner by the families who used her in a family practice (71). In another study of a family practice, Spitzer also reports high satisfaction with the nurse practitioner by both patients and professional personnel (115). Steinwachs explains that because of the care received and the general acceptance of health practitioners, the staffing mix of a group practice changed from primarily physicians to a majority of health practitioners over a three year period (118). Initial feedback from Vickery's evaluation of the AMOSIST program also indicates patient acceptance of the system (126). In addition, Day has found that 94% of the patients who used a pediatrician working with a pediatric nurse practitioner were satisfied with the care they received. And finally, Linn reports that patients showed greater satisfaction with the care they received from family nurse practitioners than with that received from traditional providers in four out of five areas (66).

As has been shown by these examples, the use of allied health personnel in all phases of health care can increase physician productivity, and is a rapidly expanding answer to the problem of improved patient flow.

Triage

Another relatively new principle for improved patient flow in an outpatient setting is the use of a triage agent, or an impanelment concept. Triage is the process of assigning priorities,

in terms of time and of provider, to patients who are seeking medical care. The term "triage" originated on the battlefield, where personnel needed to develop a system to determine which patient should be seen first at military field hospitals faced with mass casualties. Although this process has since evolved to use in many other settings besides the life and death situation in which it originated, the basic process involved has remained fundamentally unchanged. Briefly, this process involves a priority sorting of patients. The most serious patients are scheduled to be seen ahead of those who have relatively minor problems, and in some applications, a further decision is made as to which provider the patient should see to receive his care (125).

There are a number of elements involved in implementing triage systems in order to improve patient flow. As Slay has stated, "To be effective, a triage system must be rapid, medically sound, uniform in its disposition, and make dispositions in accordance with the qualitative and quantitative medical and surgical resources available (109:875)." Careful consideration must be given to the medical qualifications of the triage agent, the resources available to the agent, and the setting in which triage is used.

Various studies have been conducted to determine the effectiveness of a variety of triage agents (1, 17, 70, 73, 95, 109), and the medical skills of the triage agents have ranged from those of a receptionist to those of a physician. Slay maintains that effective triage can be performed by personnel with no previous medical experience, by using an algorithm-directed triage system (109).

Furthermore, Donald M. Vickery, in working on Project AMOS at Ft.
Belvoir, Virginia, has developed an excellent algorithm-directed
system (125). Mechaber reports that licensed practical nurses at the
Rochester Neighborhood Health Center have shown excellent judgment in
directing patients to proper areas for medical care, and have generally
been effective as triage agents (70). Similarly, reporting on a study
conducted at the Kings County Hospital Center in New York, Russo
found that in a comparison of the performance of pediatricians and
nurse practitioners, the evaluations agreed 84% of the time. This
shows that a considerable savings in physician time could be realized
by the use of pediatric nurse practitioners as triage agents (95).
In other studies done using specially trained nurses as triage agents,
Mills reported an overall triage accuracy of 98% (73), and Albin
found a 3% mistriage rate (or 97% accuracy) at the Bronx Municipal
Hospital Center (1). Finally, DeAngilis conducted a more comprehensive
study, involving comparisons of pediatricians, pediatric nurse
practitioners, registered nurses, and receptionists as triage agents.
Although physicians and nurse practitioners were found to be best,
registered nurses and receptionists were also safe and were thought to
be more cost-effective in certain settings (17).

In considering the resources that should be available to the
triage agent, Vickery recommends that a physician and physician's
assistant should be available to the triage agent at all times. Here
he uses the term physician's assistant to indicate either a physician's
assistant, nurse practitioner, Medex, or any other type of assistant
with similar training. In addition, he recommends that the physician

be a generalist, competent to handle a wide variety of problems, and mentions that referrals to specialists would more properly be made by the physician rather than by the triage agent (125).

A review of the literature has shown that by far the most common and effective uses of triage occur in outpatient settings for patients arriving without appointments, usually in emergency rooms (1, 73, 94, 109, 125, 128, 129, 130). In all of these studies, triage systems used in emergency departments resulted in more efficient operations and the increased productivity of health care providers. Since one aspect of triage is the screening of patients which results in some cases with non-urgent conditions being scheduled for care at a later date, Weinerman reports that the emergency room load at the Grace-New Haven Community Hospital was reduced 20% after the institution of a triage system (130). Once again it is obvious that triage is also an effective method for improving patient flow in a health care delivery system. It is this principle of triage that will serve as the main focus of this report.

CHAPTER 3

SPECIFIC BACKGROUND

Triage, or the priority sorting of patients, is currently gaining in acceptance and utilization in health care delivery systems. Although, as stated previously, the primary area of use has been in emergency rooms, other areas of outpatient care are beginning to adopt this method. One example of this is the general practice clinic of the USAF Hospital located at Williams AFB, Arizona.

The Williams AFB hospital is a small military hospital which provides inpatient and outpatient care to active duty and retired military personnel and their dependents. Inpatient capabilities include a 33 bed medical/surgical ward, and an 8 bed OB/GYN ward. Outpatient care is provided by a number of clinics, primarily general practice, OB/GYN, pediatrics, and flight medicine. There are approximately 10,000 patients seen each month in the various clinics.

Prior to the implementation of the panel, or triage, system, the general practice clinic operated under an individual appointment system. (See Appendix 1) Appointments were scheduled for fifteen minute intervals beginning at 8:15 AM. The last appointment in the morning was scheduled for 11:45 AM. Appointments began again at 1:00 PM, with the last appointment scheduled for 4:15 PM. With allowances for a morning coffee break and afternoon rounds, providers were available for service for 26 fifteen minute appointment slots during a normal day. Of these 26 appointment slots, a certain number were reserved for patients with acute problems, to be filled on a

same day basis only. In addition to these, military sick call was held during the first part of the morning. Appointments were not scheduled for this period, but rather each provider was available to see active duty military on a walk-in basis. Prior to the implementation of impanelment, however, military sick call was eliminated because the demand for those slots was not as great as the availability. Active duty military were then seen through the use of urgent appointment slots which were reserved specifically for their use.

Under the old system as well as under the present system, all appointments for the general practice clinic are made through a central appointments clerk. Access to the clerk is by telephone only. This is done either by calling the clerk from outside of the hospital or by using a direct line telephone in the hospital. The appointment desk opens at 7:00 AM. This method of access is quite common, and is recommended by Rising in order to provide for faster service and to train patients to telephone for appointments in advance (86).

The general practice clinic itself is situated in an easily accessible area of the hospital. The staff consists of seven health care providers: three physicians, three physician assistants, and one nurse practitioner. There are also five medical technicians. These medical technicians are normally the first point of contact for the arriving patient. The technician sitting at the reception desk logs the patient's arrival on the clinic's appointment sheet and makes the initial entry in the patient's medical records. The patient is then directed to either the appropriate waiting area for the provider he will be seeing, or to the screening area if the taking of vital signs

FIGURE 1

LAYOUT OF THE GENERAL PRACTICE CLINIC

USAF HOSPITAL WILLIAMS AFB

To Flight Medicine

Waiting Area

| P | NP |

To Pediatrics

| P | In Baskets |

Reception Desk

Hall

Screening

In Baskets

| P |

To Pediatrics

To Lab and X-ray

| PA | PA | PA |

Waiting Area

P - Physician
PA - Physician Assistant
NP - Nurse Practitioner

Not to Scale

To Main Entrance
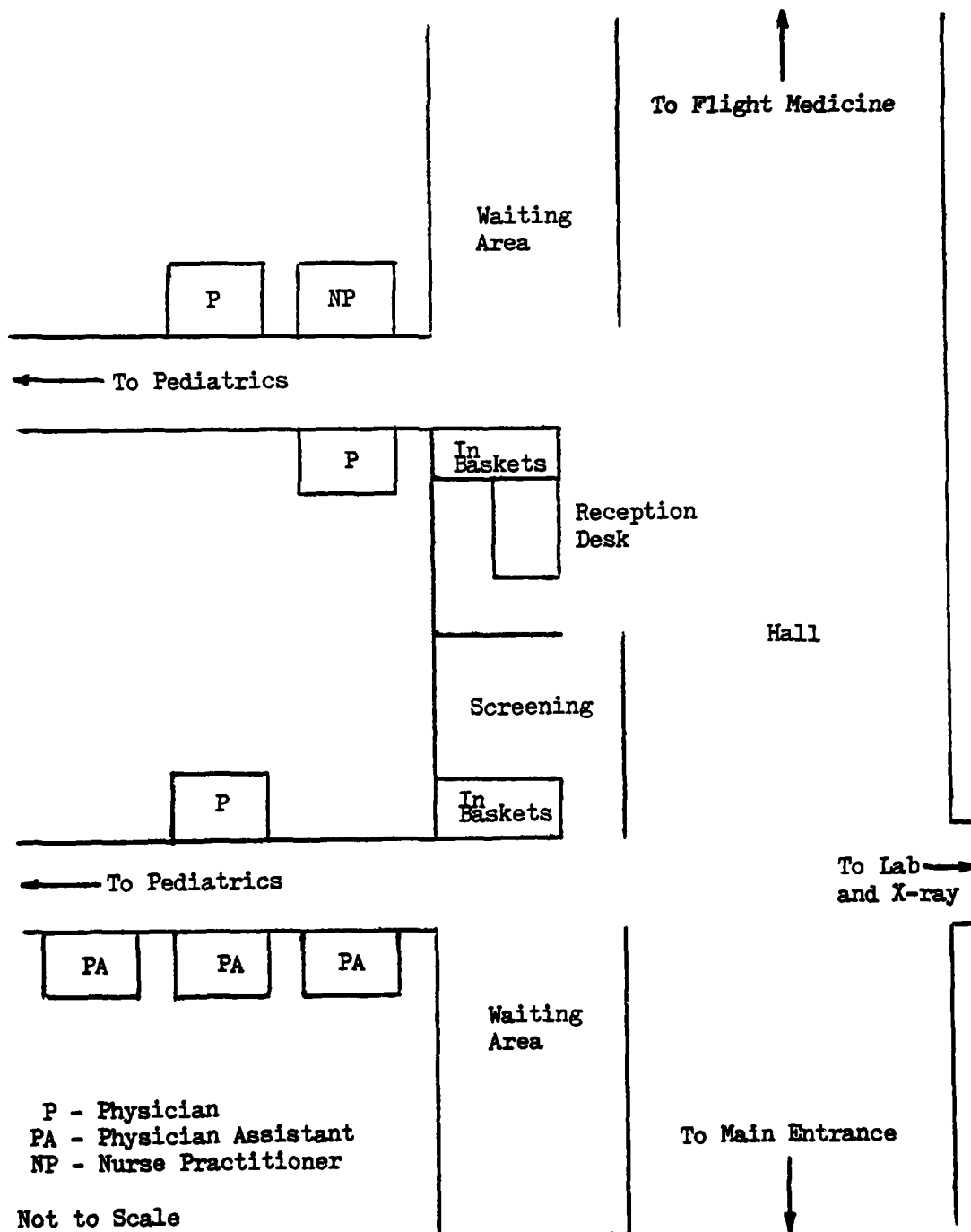
is indicated. In the screening area, another medical technician will take the vital signs and then direct the patient to the appropriate waiting area.

Providers are notified of a patient's arrival when the technician places the patient's medical records in an in-basket located in the waiting area. After seeing a patient, the provider returns the records to the reception desk, and then checks his in-basket to call his next patient. If lab tests or X-rays are indicated and the patient is to wait for the results and then return them to the provider, the patient will keep his records and then return them to the reception desk along with the completed lab work. The records will then again be placed in the appropriate in-basket so that the patient can once more be seen by the same provider.

During a recent staff assistance inspection of the hospital, one of the findings was that the appointment system used by the general practice clinic was inadequate. It was felt that the waiting period for routine appointments was too long (usually about two weeks), that more people could be seen each day, and that the number of same day or urgent appointments could be expanded. In an effort to make these improvements, an impanelment system, based primarily on Vickery's work (125), was instituted in the general practice clinic. Long range plans call for total integration of the impanelment system, but for the period of this study the individual appointment system is being used along with impanelment.

Currently, a panel consists of four members. Two members of the panel perform the triage, or screening function, and the remaining

FIGURE 2

TRIAGE PATIENT FLOW

USAF HOSPITAL WILLIAMS AFB
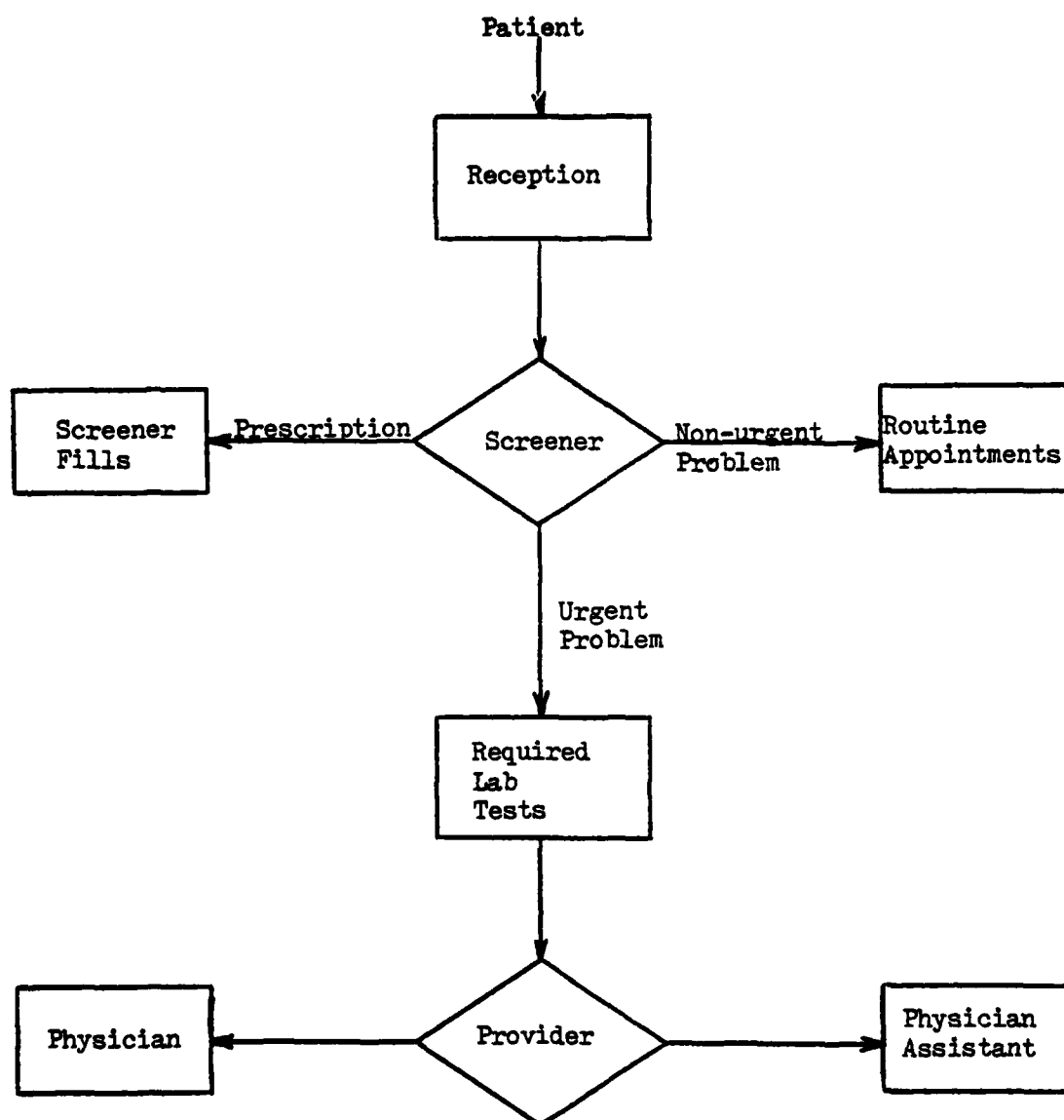
two care for the patients. One physician and one physician assistant
are assigned to patient care. Another physician assistant and a
medical technician perform the screening function. It should be noted
that in this instance, the term physician assistant includes the nurse
practitioner. The technicians are included in the screening process
to gain experience and training, in preparation for the expansion of
the impanelment system, when, according to plan, they will perform
some screening functions independently.

When the panel was first instituted in the clinic, a
combination of modified block and individual appointment systems was
used. (See Appendices 1 and 2) Patients were first given an
appointment with the screener. These appointments were scheduled for
three blocks in the morning (eight at 8:30 AM, six at 9:30 AM, and
five at 9:45 AM), and two blocks in the afternoon (eight at 12:45 PM
and nine at 1:45 PM). Subsequent individual appointments at ten minute
intervals for physician assistants and twenty minute intervals for
physicians were then scheduled by the screener. After an initial
evaluation period, a few changes were made in the panel schedule.
Patients are currently scheduled for screening during five blocks in
the morning (four each at 8:30 AM, 8:45 AM, and 9:30 AM, three at
9:45 AM, and seven at 10:30 AM) and four blocks in the afternoon (four
each at 1:00 PM, 1:30 PM, and 2:00 PM, and five at 2:30 PM). The
screener assigns patients to the care of either a physician or
physician assistant, and they are then seen as soon as possible by the
health care provider on a priority basis according to the severity
of their illness.

The remaining providers in the clinic continue to see patients on an individual appointment basis. The providers rotate duties and are scheduled on the panel for one week at a time. If patients need a follow up visit, they can be scheduled for the same provider they saw initially by calling for an appointment through the appointments desk. They can then arrange for the appointment during the following week or whenever the next appointment with that provider is available. Should it be necessary for the follow up appointment to be within a definite time period, three days after the initial appointment for example, and there is either no appointment available or the provider will be on the panel that day, provisions have been made so that the patient can still see the original provider. If the provider is not scheduled for the panel, but does not have an appointment available, he can personally call the appointments desk and schedule the patient for one of the reserved urgent appointment slots. This can be done by any of the providers in the clinic, to insure that they will be able to follow up on their own patients. If the provider will be on the panel, the patient can be scheduled for one of a limited number of individual appointments included in the schedule. The first two morning appointment slots for the three providers serving on the panel are scheduled on an individual basis. In addition, the first two in the afternoon for the physician and physician assistant who are treating the patients are also available on an individual basis. The screener does not have this option in the afternoon since screening begins at 1:00 PM, immediately after the lunch hour.

There is no special area set aside for use exclusively by the

panel. Providers assigned to the panel use their regular offices and examining rooms for screening as well as treatment.

All providers are expected to be in the clinic by 8:00 in the morning. Since this is a small facility, providers working in this clinic can also admit patients for inpatient care. Normally, in a larger facility, admissions are handled by specialists. Because of this, except for providers working on the panel, the first 15 minutes of the day are blocked off for rounds, as is one 15 minute period in the afternoon. Depending upon the provider, this is at either 4:00 PM or 4:15 PM.

Based upon this understanding of the two parallel systems being used and the requirements of the clinic and facility implementing them, it will now be possible to objectively evaluate and compare the new system to the old. Thus the objectives of this study are as follows: to analyze the two different appointment systems now in use, to compare these two systems, and then to make recommendations that would improve patient flow in this clinic.

CHAPTER 4

RESEARCH METHODOLOGY

Objectives

Simply stated, the primary objective of this research is to analyze and compare patient flow. Because of time and resource limitations, this study will be restricted to the general practice clinic at the Williams AFB Hospital. The main focus will be on the new impanelment system.

As mentioned earlier, impanelment promises to be a successful method for improving patient flow. A number of clinics have shown definite improvements in many aspects of patient flow after an impanelment or triage system has been instituted. Specific areas of improvement have included the number of patients seen, waiting time, appointment availability, and the routing of patients to the providers best able to care for them. Because impanelment is being implemented in this case in order to improve upon the service previously provided by an individual appointment system, the crux of this research will be a comparison of the two systems. However, the study is planned to include a number of areas.

The major area of analysis will be the impanelment system. It is hoped that enough definitive information on the system will be obtained to reach significant conclusions on its effectiveness. Data will be collected on a number of different aspects, including the number of patients seen each day, patient waiting time, the time of completion of care for the last patient of each period (morning or

afternoon), and patient satisfaction with the system. Since the individual appointment system is being operated in parallel with impanelment, a simultaneous study based upon the same criteria will also be made on this system.

Based upon the data collected, these two systems will then be compared in an effort to determine the effectiveness of impanelment in improving patient flow. In addition, patient satisfaction with the two systems will also be compared. After determining which system, if either, is superior in terms of overall performance, recommendations will be made for further improvements.

Scope

Because this is a small facility, the general practice clinic serves as a scheduling and reception base not only for the primary health care personnel described earlier, but also for a small number of specialists as well. Although a small part of the duties of the medical technicians consists in the support of these specialists, they do not affect the operations of the other areas of the clinic and will not be studied.

Improved patient flow and provider productivity could be realized by a number of improvements besides impanelment. For example, one improvement which could be made would be to increase the number of providers to create greater appointment availability. Similarly, improved service and waiting times could also be realized through the use of multiple examining rooms for each provider. This topic was discussed during informal interviews with these providers, and it was

felt that generally a great deal of service time is wasted in waiting
for the patient to dress or undress. Multiple examining rooms would
allow the provider to work with a second patient while waiting for the
first one to dress, which naturally would result in increased
efficiency in terms of patient flow and physician utilization.

There are also a number of other improvements that might
possibly be made in the area of physical capabilities. None of these
really need to be discussed, however, for the following reasons. In
the first place, the hospital is considered to be fully staffed, and
Air Force manning policy strongly discourages overstaffing. And
secondly, the hospital utilizes all available areas for patient care,
and there are no additional areas which could be used to improve the
physical facilities available for use by the general practice clinic.
Because of these and other factors, the following are to be considered
constants for the purposes of this study: the number of examination
rooms and providers offices, the number of physicians, physician
assistants, and medical technicians assigned to the clinic, and the
appointment personnel and appointment making procedures.

Falling under the jurisdiction of the Air Training Command
(ATC), the USAF Hospital at Williams AFB is also responsible for
following the rules and guidelines of that command. Included among
these is a letter from Brigadier General Wesp, the ATC Command Surgeon,
outlining guidelines for the evaluation and operation of outpatient
clinics (132). These guidelines will be considered in the evaluations
and recommendations made in this study and are discussed more fully
in Chapter 6.

Anticipated Results

Prior to conducting the formal survey, tentative expectations regarding the operation of the general practice clinic had been developed. These preconceived ideas were based not only upon a thorough review of the pertinent literature, but also upon personal knowledge and experience in obtaining service from this and other similar clinics. Among the attributes expected were: mean provider service times of less than 15 minutes; mean total service times of less than 45 minutes; shorter provider service times for the patients seen by the panel than for those seen on an individual appointment basis; slightly, but not significantly, longer total service times for impanelment patients; and, on the average, patients arriving early for their appointments. A no-show rate of 10% at most, but probably much less, was also anticipated.

Personal experience has shown that consultation times for most problems tend to range from five to ten minutes. In support of this estimate, Jackson reports a mean consultation time for general practitioners of 4.55 minutes (45). However, the Nuffield Study inicates that the average consultation time in general practice clinics is 8.7 minutes for established patients (based upon 561 observations), and 25.2 minutes for new patients (131 observations). The overall consultation time for this group averages 11.82 minutes. Furthermore, the mean consultation time for a number of specialty clinics along with the general practice clinic was found to be 13.57 minutes (based upon 5618 observation) (77). But in contrast, Soriano reports mean consultation times of 20.1 minutes (111).

Since large numbers of patients in the waiting area of the clinic, indicating average service times longer than appointment intervals, were never observed, and because of the majority of the various studies showing average consultation times of less than fifteen minutes, it seemed most likely that consultation times in the general practice clinic would also average less than fifteen minutes.

As used here, total service time is defined as the total time between the patient's arrival at the clinic and the time he completes service with the provider. It does not include time spent at the pharmacy, labs, or other areas, unless the patient is to wait for results and then return to the provider for further consultation or examination. The expectation that the mean total service time would be under 45 minutes was also based primarily on the results of the Nuffield Study (77). This study surveyed approximately 12,500 outpatients at 60 hospitals and found that the overall mean waiting time for patients, from their appointment time until seeing the doctor, was 25 minutes. Combined with the overall average service time of approximately 14 minutes, and an average arrival time of 6 minutes early, the average total service time of the patients surveyed for the Nuffield Study was 45 minutes.

Another related finding of the Nuffield Study was that clinics started seeing patients an average of 12 minutes late. Investigating this, it was found that "If a clinic starts late, the delay is normally perpetuated throughout the whole course of the clinic and the waiting times of virtually all the patients are increased (77)." The report concluded that this wait averaged at least two-thirds of the

time that the doctor was late in starting his clinic. Similar

conclusions were also reached by Fetter and Welch in their independent

studies (21, 131). Based primarily upon personal experience, it was

felt that providers in a military facility would tend to be more

punctual than their civilian counterparts. If all other factors

were comparable, it was assumed that the general practice clinic

could therefore improve upon the 45 minute total service time shown

in the Nuffield Study.

The opinions of the providers working in the clinic weighed

heavily in making the assumption that provider service times would be

shorter for the patients seen by the panel than for those seen on an

individual appointment basis. It was generally felt that an acute

minor illness could be treated much more rapidly than chronic problems.

For example, the treatment for a bad cold is fairly standardized and

requires little time for diagnosis, whereas a patient with a chronic

back pain could have any number of problems, requiring a variety of

treatments and considerable time for proper diagnosis. Since triage

is designed for patients who feel that they need to be seen on a same

day basis, it seemed most probable that the majority of them would

have some type of acute minor illness. Conversely, it was also felt

that the majority of patients with chronic problems would schedule

themselves for routine appointments. Commenting on a similar

situation, Rising states that "Research has also shown that service

times are longer, on the average, for appointment visits than for

walk-in visits (86:24)." Following the same logic, this would be true

because the majority of the walk-in visits would be for acute minor

problems, while the majority of appointment visits would be for chronic problems.

The slightly longer total service times for impanelment patients would stem from a few of the differences between the systems. Because of the differences in treating acute vs. chronic problems, the average provider service time would probably be at least five minutes shorter, but most likely not more than ten minutes shorter, for impanelment patients. However, because of the necessity of first seeing a screener and then the appropriate provider, and because block arrivals would cause slightly increased waiting times, an additional fifteen to twenty minutes would probably be added to the total service time. Therefore, taking both of these factors into account, it was felt that the actual total service time for impanelment patients would be about ten to fifteen minutes longer than the total service time for patients with individual appointments. Lacking definitive studies to back up these estimates, they are based instead upon the opinion of clinic personnel and upon personal estimates of the times involved.

Because of the results of the Nuffield Study, indicating average patient arrival times of six minutes early, it was felt that patients in the general practice clinic would tend to arrive earlier than their scheduled appointment time. This determination of average early arrivals substantiated similar findings by Welch in an earlier study for the Nuffield Hospitals Trust (131). Schwartzman, at a much later date, also found that patients in a physical therapy clinic averaged an arrival time of two minutes prior to the appointment

time (100). These results tended to confirm personal habits and prejudices, and led to the expectation of early arrival times.

Finally, as reported previously, the minimum no-show rate in a number of clinics ranged from about 7% to 9%. In talking with the administrators of this hospital prior to the study, it was found that there was no accurate knowledge or determination of the no-show rate for the hospital. The administrators felt that it might be 1% to 2%, but that whatever it was, it was certainly not a problem. Based upon this, the expectation of a no-show rate of no worse than 10% developed. If a rate of 10% or less were found, this would be considered acceptable, and would not be an area in which improvements need be made.

Method

After deciding which aspects of the two systems to compare, and after determining what results would be most probable, the next step in the research process was to decide how best to gather the data necessary to make the comparison. Although a number of reference works were consulted, the method used for data collection was suggested mainly by two recent works by Rising and Stamps (86, 116). Primary data was obtained through the use of two questionnaires. The medical technicians at the reception desk were asked to hand the questionnaires to the patients when they arrived at the clinic and then to collect them when they had completed their visit.

Questionnaire A (See Table 1) was designed primarily to determine service times. The medical technicians were asked to circle

TABLE 1

QUESTIONNAIRE A: INFORMATION AND PURPOSE

Question No.	Information Requested	Purpose(s)
1	Last four SSAN	Correlating data
2	Clinic arrival time	Early or late arrival Total service time
3	Time appointment made	Appointment availability
4	Time same-day appointment made	Appointment availability
5	Follow-up appointment	Appointment availability
6	Time of screening	Waiting times
7	Start and end of provider service	Provider service time Total service time
8	Lab tests	Percentage of lab tests ordered by screener
9	Lab tests	Percentage of lab tests ordered by provider
	Second provider start and end of service	Provider service time Total service time
10	Referral to doctor by PA	Mis-triage rate
	Start and end of service	Provider service time Total service time

P or A on the top of the questionnaire to indicate whether the patient was seeing the panel (P) or had an individual appointment (A). Patients were asked to answer ten questions pertaining to the service they received that day. The first question asked for the last four numbers of the sponsor's Social Security Account Number (SSAN). The sponsor is either an active duty military member or a retired military member, and his "last four" is consistently used as a standard means of identification for him and all of his dependents. This information was requested for use in correlating questionnaire data with data collected from other sources, mainly from clinic appointment logs. Question two asked for the time of arrival at the clinic. This was needed in order to compute service and waiting times. Questions three, four, and five asked for information on when the appointment was made, and also whether or not it was a follow-up appointment. The purpose in gathering this information was to try to determine appointment availability. Question six asked for the time the patient was seen by the screener in order to determine waiting times before the initial triage encounter for impanelment patients. Questions seven through ten asked for information concerning the type of provider seen, provider service times, and patient flow through the clinic. It was hoped that these questions would provide information concerning lab tests ordered by the screener prior to service by the provider, as well as provider service times and waiting times. In addition, question ten was also designed to help in the determination of mis-triage rates, by indicating patients who were first sent to the physician assistant when they should have been sent directly to the physician.

Rising suggests a variety of methods for obtaining this type
of information. The simplest method suggested was the one that was
used in the Nuffield Study (77). Using this method, providers are
asked to record the amount of time spent each day doing tasks
unrelated to patient service, such as lunch, coffee breaks, personal
telephone calls, and so forth. At the end of the period of study
(three days is recommended), these times are subtracted from the total
time the provider spent in the clinic, and then the difference is
divided by the total number of patients seen to compute the average
service time. In contrast, the most complex method was to give each
person a card when he entered the hospital. A time-stamp machine would
be positioned at each service station the patient could possibly visit,
and in and out times would be stamped on the patient's card each time
he visited a station. It was hoped that Questionnaire A would provide
more accurate and specific information than the first method, without
the need for elaborate and unavailable equipment as required by the
second method.

Questionnaire B (See Table 2) was designed to ascertain
patient satisfaction with the service received at the hospital. The
medical technicians were again asked to circle a P or an A, indicating
the type of appointment, in an effort to make a comparative analysis of
the two systems. Question one asked the type of provider seen by the
patient. This information was needed in order to see if there was any
difference in the patient's degree of satisfaction between the care
received from the various types of provider. Questions two and three
asked about the patient's waiting time, in order to determine whether

TABLE 2

QUESTIONNAIRE B: INFORMATION AND PURPOSE

Question No.	Information Requested	Purpose(s)
1	Type of provider seen	Type of provider seen
2	Waiting time	Waiting time
3	Reaction to waiting time	Patient satisfaction with waiting time
4	Ratings of various aspects of services and personnel in clinic	Patient satisfaction
5	Most liked aspect of hospital	General comments
6	Least liked aspect of hospital	General comments
7	Suggestions for improvement	General comments

waiting times affected the patient's satisfaction with the system as a whole. Question four asked for subjective ratings of excellent, good, average, fair, or poor on seven areas of the clinic's operation. These areas included general evaluations of service and the appointment system, as well as evaluations of the staff. Questions five, six, and seven requested open-ended evaluation of the hospital. Although it was hoped to discover certain areas which were consistently considered to be either good or bad by the patients, the main purpose of these last three questions was to provide patient comments for the hospital administrators rather than to be the basis of any major finding of this report. Questions four through seven were based on suggestions given by Stamps for measuring patient satisfaction (116).

In the course of the development of the questionnaires, a number of revisions were made. It was felt that the simpler the questionnaire, the more cooperative patients would be in completing it. To accomplish this, the original design was to have each questionnaire fit on one half of a standard sheet of paper, assuming that a smaller questionnaire would appear less formidable to the patients. Sample questionnaires were then distributed to some fellow students and to several patients in the general practice clinic, and they were asked for a critique of the questionnaire, especially in terms of understanding the questions. The students found all the questions easy to understand, with the exception of one which asked the patient whether or not he had been seen by the panel. It seemed obvious that the patients would know whether or not they were being seen by the panel, but when the questionnaires were distributed to

several patients, it was apparent that they too wondered what a panel was. Consequently, this question was dropped from the final questionnaires, and the system of having the technicians mark a P or an A was substituted. The only other major change that was made was in the layout of the questionnaires. Although the questionnaires could each be fit on a half sheet of paper, they appeared quite crowded. By spacing the same number of questions onto an entire sheet of paper, a much more appealing and simpler format was achieved.

Additional data was gathered from existing records kept at the hospital. The main source for this information was the appointment logs kept at the clinic. At the start of the clinic day, one copy of the appointment log for each provider is sent to the reception desk in the clinic. Since the appointment desk opens earlier than the clinic, some of the urgent and panel appointment slots are already booked. Urgent and panel appointments filled after this time are recorded in central appointments, and then the information is telephoned to the clinic so that it can be recorded on the clinic's logs. As patients arrive, they are checked off on the logs by the medical technicians. No-shows and cancellations are also noted. In addition to this, each provider on the panel keeps a log of the patients he has seen. This information can then be matched against the master log for the panel in order to determine the number of patients sent to each type of provider, and also the number that were seen only by the screener, primarily for prescription refills, or told to make an appointment at a later date. The appointment logs were especially important in determining the number of patients seen by the providers and the no-

show rate, and in matching scheduled appointment times with questionnaires through the use of the "last four." The scheduled appointment time was not included as part of the questionnaire in an effort to keep it as concise as possible, but in retrospect, it should have been included for ease of data analysis.

A primary concern in developing the data collection methods was to minimize inconvenience and interruptions to the providers. Therefore, most of the data collection procedures excluded any need for their participation. However, in order to determine the times for first patient seen each period and completion of service for the last patient, it was felt that the easiest and most accurate method would be to ask the providers. To accomplish this, a simple form for use in recording this information was distributed to each provider prior to beginning data collection.

FIGURE 3

START AND END OF SERVICE FORM

Provider:		MON.	TUES.	WED.	THUR.	FRI.
Time first patient seen	AM					
	PM					
Time last patient leaves	AM					
	PM					

In an attempt to determine the accuracy of the questionnaire
data, the operation of the clinic was observed for two full days.
Arrival times, provider service times, the type of provider assigned to
triage patients, and departure times were recorded. By comparing the
average service times obtained in this manner with those obtained
from the questionnaires, it was hoped that the accuracy of the patient
responses would be validated. The degree of accuracy would also be
helpful in determining the optimum length of the data collection
period. Initially, a two week period was planned, with an option to
terminate after one week if the data was felt to be accurate and
sufficient. Based on results from the Nuffield-Study, Rising
recommends only a three day period for data collection (86). It was
felt that a two week period would be much more than sufficient.

Finally, the last step in data collection was to informally
interview the physician and screener assigned to the panel during the
period of the study, in order to determine their feelings about the
acceptance of triage and about how well it was working. Also
discussed were the procedures used for screening and suggestions
for improvements. During the course of the study, the hospital
administrator, the registrar, and the chief appointments clerk were
also consulted.

TABLE 3

OBSERVED VS. QUESTIONNAIRE DATA

	Observed n	Observed $\bar{x}$	Questionnaire n	Questionnaire $\bar{x}$
Provider service time	204	11.55	143	12.98
Total service time	210	40.38	145	44.08

CHAPTER 5

RESULTS

General Observations

Based upon the literature survey conducted prior to this study, several facets of the operation of an outpatient clinic appear to be current standards for efficient operation. Although not the primary objective of this study, a number of comparisons can be made between these general standards and the operations of the Williams AFB Hospital. These suggested standards include the use of an adequate appointment system, the use of physician assistants, and the use of triage.

The appointment system in use is, in most cases, an individual appointment system, and the use of 15 minute intervals for appointments seems to indicate the use of average service time as a basis for the system. By reserving a number of urgent appointments to be scheduled on a same day basis, an attempt is being made to see patients whose problems must be handled quickly. This compares favorably with the standards suggested by the literature. Indeed, a bare minimum for efficient appointment systems appears to be appointments based upon mean service time as suggested by Bailey (7), but including some sort of provision for walk-ins or urgent problems.

Another widely recommended standard for efficient operation is the use of a centralized appointment system. Such a system is in use at this hospital. As would be expected in the operation of a manual appointment system such as this, access to the appointments

clerk is strictly by telephone. Again, this compares favorably with the standards gleaned from the literature.

Another aspect of operations which is highly recommended is the use of physician assistants or allied health personnel. Fitterer has stated that "...the Physician Assistants have become the backbone of military ambulatory patient care in military installations (24: 951)." The Williams AFB general practice clinic is no exception to this rule. The staff includes three physician assistants, one nurse practitioner, and three physicians, ample evidence that Fetterer's observation is true, in this case at least. As would be expected from a review of the literature, these physician assistants seem to be well accepted by both physicians and patients.

Triage, a relatively recent advance in improving patient flow, is also widely suggested as a means to efficient operation of hospital clinics, and is currently being used in the general practice clinic at this hospital. Although only recently implemented, the triage system appears to be running smoothly, as far as screeners and providers understanding and performing their duties satisfactorily. There is, however, a major difference between this and other triage systems reported in the literature, in that this system is being used primarily on an appointment basis, rather than as a means of handling walk-ins or emergencies.

Questionnaire Results

Perhaps inevitably, the questionnaires which were distributed did not yield quite as much useful information as was anticipated. Of

the approximately 500 questionnaires handed out, only 266, or about

50%, were returned. Most of these had some useful information on them,

although a few of them were incorrectly or incompletely filled out.

Probably the best way to review the effectiveness of the questionnaires,

however, is to discuss them one question at a time, beginning with

Questionnaire A (See Table 1).

For the most part, the medical technicians did remember to

circle the P or A on the top part of the questionnaires prior to

handing them to the patients, although they didn't always remember to

pass out the questionnaires. The first question, the sponsor's "last

four," was answered by almost all of the patients, although some people

did leave it blank, probably to guarantee their anonymity. By matching

this number with the number included for each patient on the

appointment logs, it was possible to determine which provider saw the

patient and what his appointment time was, since these questions had

not been included on the questionnaire in an effort to keep it as

simple as possible. However, because of the difficulty encountered in

matching questionnaires to appointment logs, it is recommended that

future questionnaires include a question on scheduled appointment time.

Questions two, six, seven, and nine, concerning arrival,

departure, and service times, appear to have been answered fairly

accurately, based upon a comparison of the mean service times obtained

from the questionnaires and those obtained by personal observation,

with one minor problem. For the most part, patients tended to round

to the nearest five minutes. Despite this, it is felt that because

of the large sample, the sample means are still representative of the

true means.

Questions three, four, and five asked for information on when the appointment was made, in an effort to determine appointment availability. Although these questions were generally answered accurately, the information requested was not really as useful as had been hoped. This is because the date when the appointment was made does not necessarily indicate the latest date that the appointment could have been made. However, judging by the number of same-day appointments, and by the fact that those calling in the morning almost always got morning appointments, these questions do seem to indicate that the system is working well as far as the availability of urgent appointments is concerned. Furthermore, a waiting period of approximately one week for routine appointments was determined through an informal interview with the chief appointments clerk. This compared favorably with the approximately ten days to two weeks waiting period prior to the implementation of the triage system.

A number of problems arose with the remaining questions, numbers six through ten. For one thing, as mentioned earlier, the patients tended to round off answers to the nearest five minutes. The main problem, however, lay in their understanding the questionnaire. A basic assumption made during the development of the questionnaire was that the triage patients would know when they were seeing the screener, as distinguished from when they were seeing the provider. This assumption seems to have been false, since the time given for question six was the same as the start time for question seven on several of the questionnaires. Many patients also failed to complete

this and other portions of the questionnaire, with questions nine and ten answered on less than 1% of them. It is impossible to determine whether this high degree of incompleteness is due to patients' simply failing to finish answering the questions, or whether it is an indication that only a very small number of patients were mis-triaged or asked to complete lab tests prior to being seen by the provider.

Because of the problems already discussed, the only useful information gained from Questionnaire A was the average total service times, the average provider service times, and the average arrival times as related to appointment times.

Questionnaire B (See Table 2) was answered more completely in most cases, probably because it was simpler. The first three questions were used in making comparative analyses of the answers to question four. By doing so, it was discovered that, among the variables, long waiting times have the greatest effect on the patient's attitude toward the clinic as a whole. Nevertheless, it should be noted that 76% of the patients answering this portion of the questionnaire felt favorably about the overall service at the hospital.

As mentioned previously, the last three questions of Questionnaire B were included mainly for use by clinic personnel. Although these answers were not tabulated because no trends were discernible, some interesting comments were received. Patients alternately liked and disliked the appointment system, the doctors, the medical technicians, and other aspects of the clinic. A number of people commented on the distance from their homes to the hospital, some liking it because it was close. and others disliking it because it

was too far away. One person liked "the friendliness of the staff,"
and another found that "once I see who I'm supposed to, they are very
kind." Occasionally specific problems were mentioned, as the patient
who was dissatisfied because "they won't fix my overbite." The survey
itself even got one response--the patient liked it because that was
"the first time I have not waited for 30 min.--1 hr. and watched the
doctors going back and forth with their coffee and stopping to chat
with fellow Dr. or nurses."

Major Findings

In analyzing the responses to Questionnaire A, it was found
that the distribution of service times came from what appeared to be
exponential rather than normal populations. In practice this means
that there are a large number of short service times with a much
smaller number of long service times. This result was expected, as
Welch and Bailey had made the same observation (131). Because of this,
the Mann-Whitney-Wilcoxon test (31:164-167, 192), as well as the
student-t test, was used to determine whether the differences in the
means computed was significant. (See Appendix 4) The Mann-Whitney-
Wilcoxon test was chosen because it makes no assumptions about the
underlying distributions, other than that they come from the same
population. The student-t test was then used to reinforce the
results of the Mann-Whitney-Wilcoxon test (138).

In all cases comparing mean service times, and also in comparing
average differences in arrival time vs. appointment time, the following
criteria were used. The null hypothesis, that the two sample means

were equal, was tested against the alternative hypothesis, that one was less than the other. P values of .10 or less were considered to be significant.

As expected, the provider service time for triage patients was less than that for appointment patients (8.55 min. vs. 12.45 min.). This difference was significant with $P = .0013$. However, since both means were less than the 15 minute period allowed for appointments, it is felt that either would be acceptable and that neither would account for excessively long service times.

There was a significant difference ($P < .0002$) between the two systems in total service times. While patients with regular appointments were in and out of the hospital in an average of 37.5 minutes, triage patients took an average of 68.3 minutes, or almost twice as long. Although a slightly longer time was expected, this difference is much greater than anticipated and must be considered a major drawback of the impanelment system.

A further area of study was patient arrival times. Again, there seems to be a significant difference ($P = .0746$) between the arrival habits of the two types of patients. Appointment patients tended to arrive an average of 12.7 minutes early, whereas triage patients arrived an average of 19.6 minutes early. This is probably due to the fact that triage patients are requested to pick up their records at the front desk before reporting to the general practice clinic. However, this difference is not large enough to account for the discrepancy in total service times. In fact, when this difference is combined with the difference in provider service time, the effect on total service time of 3 minutes is negligible. (See Table 4)

TABLE 4

THE EFFECT OF DIFFERENCES IN ARRIVAL TIMES AND PROVIDER SERVICE TIMES
ON TOTAL SERVICE TIMES

	Panel	Appointment
Total Service Time	68.3 min.	37.5 min.
Difference	+30.8 min.	
Minutes Patients Arrive Early	19.6 min.	12.7 min.
Provider Service Time	8.55 min.	12.45 min.
Effect on Total Service Time	28.15 min.	25.15 min.
Difference	+3.0 min.	

Based strictly upon the master schedules, rather than upon actual performance, appointment availability was computed by using the average number of appointment slots that could theoretically be scheduled for each provider. (See Appendices 1 and 8) If the clinic were run entirely on an individual appointment basis, there would be an average of 84 urgent appointment slots available each day. Under the current triage system, an average of 87.2 urgent slots are

available each day. However, to achieve this slight gain in urgent appointment availability, the total number of patients that can be seen each day has been drastically reduced. Under a pure appointment system, an average of 165.9 patients could be seen in the clinic each day, while under the impanelment system only 149.4, or 16.5 patients less, can be seen daily. In an effort to compare this theoretical loss with actual practice, the performance for two months, January and September 1979, was examined. Based upon hospital records, the average number of patients seen per provider per day in January was 20.2. In comparison, in September, after the implementation of impanelment, the average number of patients seen per provider per day was 16.9. Assuming seven providers, this is approximately 23 patients less per day, which is even greater than the theoretical figure of 16.5. This difference in the number of patients seen is due primarily to the fact that three providers are eliminated from the individual schedule, in order to use only two providers for actual patient care on the panel, with the third merely doing the screening.

Questionnaire B was used to determine patient satisfaction with the operation of the clinic. As previously mentioned, the first three questions were used in making comparative analyses of the answers to question four. For ease in comparing patients' feelings about the service they received and about the various personnel in the clinic, the five areas of response (Excellent, Good, Average, Fair, and Poor) were combined into two categories. The Excellent and Good responses were combined to form the "favorable" category, and the remaining responses formed the "unfavorable" category. Although a

number of comparisons were made between the responses to the questions and the various factors which might account for any differences (See Appendix 6), only the comparisons made on overall service are presented here because they alone were conclusive in all respects. The proportion of favorable responses was tested against the proportion of unfavorable responses to see whether the following factors were significant: whether the patient was seen by a physician or physician assistant, whether the patient was seen by the panel or as an individual appointment, and whether the waiting time was long or short. (See Table 5) In making this last comparison, a short waiting time included all waits of 10 minutes or less and also longer waits if the patient felt that the waiting time was reasonable. A chi-square test was then done to determine whether the differences, if any, in observed proportions were significant (72:253-258). The differences in satisfaction between the patients seen by a physician (71% favorable), and those seen by a physician assistant (82% favorable), and between the patients seen by the panel (69% favorable), and those with individual appointments (78% favorable), were not significant at the .005 level. However, the difference in satisfaction between the patients with short waiting times (83% favorable), and those with long waiting times (33% favorable), was significant at the .005 level. Other comparisons are tabulated and included in Appendix 6.

To determine the broken appointment rate for the clinic, the clinic appointment logs were used from a two week period that included the period of the study. During that time 865 appointments were booked for the general practice clinic. There were 48 no-shows during

TABLE 5

ANALYSIS OF OVERALL SATISFACTION

H_o: Overall Satisfaction is the same

H_a: Overall Satisfaction is not the same

degrees of freedom = 1

$$\chi^2_{.005} = 7.879$$

	PROVIDER	
	Physician	Physician Assistant
Favorable	57 (71%)	62 (82%)
Unfavorable	23 (29%)	14 (18%)

$\chi^2 = 2.523$
not a significant difference for $\alpha = .005$

	APPOINTMENT SYSTEM	
	Panel	Appointment
Favorable	25 (69%)	94 (78%)
Unfavorable	11 (31%)	26 (22%)

$\chi^2 = .7200$
not a significant difference for $\alpha = .005$

	WAITING TIME	
	Short	Long
Favorable	112 (83%)	7 (33%)
Unfavorable	23 (17%)	14 (67%)

$\chi^2 = 21.60$
Significant difference for $\alpha = .005$

that period, or a broken appointment rate of 5.5% (See Appendix 7).
Patients were counted as being no-shows if they simply didn't keep the
appointment, and also if they cancelled the appointment too late for
it to be given to another patient. This rate was slightly higher than
the estimate of the hospital administrators, but still below the
minimum rates mentioned in the literature and therefore regarded as
highly satisfactory.

A minor portion of the data to be collected concerned starting
and completion times for the providers. Each provider was given a form
on which to indicate the time he saw the first patient in the morning
and in the afternoon, and also the time that he completed care for
the last patient of each period. Out of the seven providers in the
clinic, only two returned these forms, and therefore not enough
information was received to draw definite conclusions. During
observation of the clinic, however, it did appear that providers were
beginning and ending service approximately on time.

Discussion

In order to evaluate the meaning of the data collected on the
two systems, some standard of performance must be used. Since the
main reason for implementing the triage system was to increase the
number of patients seen on a same day basis, this is one point of
comparison that must be considered. Along with this, the ten basic
tenets for assessing primary health care delivery systems as set forth
by General Wesp will also be used (132). Since these guidelines were
specifically developed for use by the Williams AFB Hospital and other

similar facilities, the major portion of evaluation will be along those lines. Finally, the expected results mentioned in Chapter 3 will also be used.

The clinic has expanded the availability of urgent appointments, although only by a very slight margin. However, since this has been accomplished at a significant cost in the total number of patients that can be seen, it is not felt that the present method is effective in achieving this goal.

The main thrust of the guidelines set forth by General Wesp is that clinics should make maximum use of impanelment and screening procedures, while at the same time ensuring an orderly flow of patients through the clinic. In this area it seems as though some improvements could be made. Generally, the screening procedures appear to be working well. Patients are being directed to either a physician or physician assistant for their care, and although no definitive data was collected in this area, it does appear as though the screener is performing accurate triage. However, the main problem with this system is the extended waiting times for triage patients, as evidenced by their longer total service times, which increase patient dissatisfaction with the clinic. Because of this, it is felt that the overall operation of the impanelment system as described in this study is not effective in improving total patient flow through the clinic. The system shows a great deal of promise though, and rather than return to an individual appointment system, a few minor changes in the operation of the system could increase the number of patients seen each day, as well as decrease the waiting times for the patients.

CHAPTER 6

FURTHER DISCUSSION AND RECOMMENDATIONS

As has been mentioned, triage is widely considered to be an effective and most promising tool for improving patient flow. In the case of the Williams AFB Hospital general practice clinic, however, triage seems to have hurt the system more than improved it. Although there has been a slight increase in the number of urgent appointments available, the large decrease in total number of patients seen per day more than offsets this gain. Furthermore, another aspect of the triage system implemented in this hospital which has hurt overall patient flow is the extended total service time associated with it. However, a few minor changes in the system could improve patient flow and yet keep triage as a basic principle.

Before explaining the recommendations which will be made for a new system, a more thorough examination of the guidelines prepared by General Wesp, the ATC Command Surgeon, and mentioned in the previous chapter, should be made. These were the primary considerations used in developing the proposed revisions for the triage system:

> 2d. Maximize the principle of empaneling patients for health care teams....
>
> 3. Develop patient-oriented scheduled systems that ensure...
>
> b. Maximal use of appointed visits.
>
> c. Health care provider effectiveness thru appropriate use of all forms of standardized scheduling techniques...
>
> e. Increased PCC, ancillary services and support staff efficiency by an orderly patient flow throughout the working day.
>
> 4. Develop a patient treatment priority system at every medical facility based on...

    d. An awareness that most non-urgent care can be seen same day and reappointed for an indepth evaluation.
    5. Develop a patient treatment routing system that:
    a. Uses formally established screening protocol at all points of entry. No PCC delivery system can work well without screening....
    c. Appropriately matches patient needs to level of provider expertise thru graduated patient care....
    6a. Concentrating on identifying and obtaining optimum resources required in the appointment desk function....
    7. Develop a system for comprehensive care that...
    b. Provides the bulk of care via the appointment mode....
    8a. Establishing medically sound protocols for routing patients with known and suspected medical/surgical conditions via appointment desk. (132)

As will be shown, two simple changes in the operation of the triage system would not only increase the number of patients seen each day, but should also decrease the waiting times for triage patients. The first of these changes would be to eliminate the use of a physician assistant as a screener, and the second to use a modified wave appointment system for the triage patients.

By eliminating the use of a physician assistant as the triage agent, another provider would be available for primary patient care. There are then two possibilities for the skill level of the new screener. One possibility is to use the medical technicians who are already in training for screening, and the second is to train the personnel at the appointments desk to do screening on the telephone. As has been shown by Slay (109), effective triage can be performed by personnel with little or even no previous medical experience by using an algorithm-directed triage system. One such system is the excellent one developed by Vickery (125), and the hospital administrator at the base has estimated that it would only require about 20 hours to train personnel in its use. By stipulating that all patients

who called for a same day appointment would be given one, the effects of mis-triage by these agents would be minimal. Since their triage function would simply be to assign the patient to either a physician or physician assistant, the worst that could possibly happen would be for the patient to be seen initially by a physician assistant and then referred to a physician, rather than being seen directly by the physician.

If the medical technicians were used as the triage agents, they could be employed in several different ways. The first way would be similar to the present screening system. After making appointments with the panel, patients would arrive at the clinic, be screened by the triage agent, and then assigned for care. However, this system alone would do little to reduce the excessive waiting times of the triage patient.

A second method would be for the screener to perform the triage over the telephone from the general practice clinic. By training all of the technicians assigned to the clinic to perform triage using an algorithm-directed system such as Vickery's, they would even be able to perform all of their regular duties as well. There are enough technicians assigned to the clinic so that no one is constantly busy. Whichever technician happened to be free would be able to answer the phone, perform the triage, and give the patient a definite appointment. Of course, this system moves away from the centralized appointment system, and would dramatically increase the number of telephone calls to the general practice clinic. However, this situation is not without precedent, as a similar system is

currently being used in the pediatric clinic at the same hospital. The effect of this method would be to drastically reduce waiting times, as the triage would actually be performed in the patient's own home and he would be able to simply report in time for his specific appointment.

A slight modification of this method would be to assign a technician to work at the appointments desk during the peak calling hours and perform the telephone screening of triage patients from there. This would have most of the same advantages as the previous method, while eliminating any need for changing the appointment making procedures, and also possibly providing additional help for the appointments desk during peak hours. However, a major disadvantage of this system lies in the fact that the medical technicians would not be able to utilize their skills and training to the fullest. This would be both inefficient and frustrating to those who would resent functioning as appointments clerks rather than as health care personnel. Similarly, if appointment clerks were trained to act as triage agents, they might resent being required to function as health care personnel, especially because they are already kept quite busy performing their regular duties.

Consequently, it is recommended that the medical technicians perform telephone screening in the general practice clinic. Since they are already being trained in this technique, they would be able to perform triage effectively almost immediately. It is also felt that patients would be more inclined to answer questions about their medical problems and history, if they knew they were consulting with

someone at the clinic rather than talking to an appointments clerk.

In addition to this change in the triage function, a change
in the appointment structure for the triage patients is also
recommended. Based upon the results of the questionnaire and other
research, it is felt that the longer total service times of the triage
patients is due not to the number of patients, but rather to
scheduling too many patients to each appointment block with the panel.
Because of the shorter provider service time for triage patients, an
average of 8.55 min. per patient, it is felt that patients could
actually be seen by providers at more frequent intervals than the
15 minute intervals used for the individual appointment system. To
accomplish this, a modified wave appointment schedule is recommended
for the physician and physician assistant assigned to the triage
panel. As shown in Figure 4, five patients, rather than four, would
be scheduled for each hour. Providers would still have ample time to
perform paperwork and other duties as each patient is, in effect,
booked for 1/5 of an hour or a 12 minute period. Appointments would
still be given at 15 minute intervals, but two patients would be
scheduled for each of the first two periods, one for the third, and
none for the fourth. This is a typical wave pattern, allowing the
provider a few minutes to catch up at the end of each hour. By
scheduling less than five patients for certain hours, time for rounds,
consults, and coffee breaks can still be worked into the schedule.
The two providers assigned to the panel would see only urgent
appointments; no routine appointments would be scheduled for them,
except for provider requested follow up appointments as under the

FIGURE 4

MODIFIED WAVE APPOINTMENT SCHEDULE

Time	Individual Appointments Number of Patients	Triage Appointments Number of Patients
8:00	Rounds	Rounds
15	1	2
30	1	2
45	1	0
9:00	1	2
15	1	2
30	1	1
45	1	0
10:00	1	2
15	Coffee Break	2
30	1	0
45	1	Coffee Break
11:00	1	2
15	1	2
30	1	1
45	1	0
12:00	Rounds	Rounds
15		
30	Lunch	Lunch
45		
13:00	1	2
15	1	2
30	1	1
45	1	0
14:00	1	2
15	1	2
30	1	1
45	1	0
15:00	Consult	Consult
15	1	2
30	1	2
45	1	1
16:00	1	0
15	Rounds	Rounds
30		
45		
Total Patients	26	33

present system. Providers in the clinic would rotate triage duties on either a daily or weekly basis.

This schedule would increase the number of appointment slots available for triage from 40 to 66. Currently, there are about 87 urgent appointments available in the general practice clinic each day, including those scheduled for the panel. Based upon information obtained in an informal interview with the chief appointments clerk, it is apparent that the demand for urgent appointments is less than the current availability. There has always been an urgent slot available for any patient requesting one. Therefore it is recommended that the total number of urgent appointment slots for the clinic remain the same. Because more triage slots would be available under the new appointment schedule, it would have the effect of increasing the number of routine appointments available for the other providers. Assuming that demand for these appointments would remain unchanged, it is probable that the waiting time for routine appointments would be reduced to less than the present one week.

If it were decided to retain the screening function in the clinic, rather than allowing it to be performed by telephone, this same increase in the number of available appointments could still be realized. Rather than schedule the patients in a wave for the providers, they could be scheduled in a wave for the screener. To do this, ten patients would generally be scheduled for each hour, with two patients scheduled on the hour, and two patients each for the next four ten minute intervals. Again, the last period would be left free, allowing the providers time to catch up at the end of each hour.

To make the wave system work most effectively, a few priorities should be used by the triage agents when scheduling appointments. As suggested by Willis (134), an attempt should be made whenever possible to schedule one traditionally short service time patient during the periods when two patients are scheduled at the same time. For example, under the present triage system, the screener sees several patients each day who are simply requesting prescription refills. These patients would be given one of the two appointments scheduled at the same time under the proposed system. Similarly, if it were necessary to use one of these slots for a provider requested follow up appointment, the provider, when requesting the appointment for his patient, would estimate whether the appointment would be relatively long or short. The patient could then be scheduled accordingly.

It is estimated that making the two changes which have been proposed would increase the productivity of the clinic, in terms cf number of patients seen each day, by 27% over the current system and by 10% over the individual appointment system. (See Table 6) These estimates were arrived at by using the appointment schedules rather than actual performance data. However, it is felt that although the clinic actually sees fewer patients per day than could theoretically be scheduled, the proportional increase in productivity would be approximately the same. Thus it can be seen that this new system would meet General Wesp's goal of making maximum use of both scheduled appointments and patient triage.

TABLE 6

APPOINTMENT AVAILABILITY*

TYPE OF PROVIDER	TOTAL APPTS.	URGENT APPTS.	ROUTINE APPTS.
	Individual System		
Physician (3)	115	55	60
Physician Assistant (4)	122	65	57
Total Average	119	60.7	58.3
	Present System		
Physician (2)	115	55	60
Physician Assistant (2)	122	65	57
Panel (3)	83	67	16
Total Average	103.3	63	40.3
	Proposed System		
Physician (2)	115	21	94
Physican Assistant (3)	122	25	97
Panel (2)	162	162	0
Total Average	131.4	63	68.4

* Average availability per week per provider, based on all providers working a normal schedule

Conclusions

In summary, it has been shown that triage, when used properly, can be an effective tool in improving patient flow in an outpatient clinic. Although the clinic at Williams AFB is making effective use of triage with respect to the screening and subsequent care of patients, this is being accomplished only with an unacceptable loss of productivity and a great increase in total service time for the patient. By changing the system slightly, both of these problems can be eliminated. The telephone screening of patients, done by medical technicians using algorithm directed techniques, coupled with a modified wave scheduling system for patients with urgent problems, can not only increase the number of patients that can be seen by a triage panel, but can also increase the availability of routine appointments. Although generally used only in emergency rooms or walk-in clinics, it is apparent that triage, applied in this manner, can also be an effective tool in improving patient flow in an outpatient clinic which is operated on an appointment basis.

It should be noted, however, that the sampling process used, a non-randomized selective sample over a four day period, is not necessarily the best sampling process, and could possibly produce biased results. Nevertheless, based on the results of the Nuffield studies (7, 77, 131), and the suggestions made by Rising (86), it is felt that the results in this case are accurate.

CHAPTER 7

RESEARCH CONTRIBUTION

This report on the effect of triage on patient flow in an outpatient clinic is significant and useful for several reasons. In the first place, although limited in scope, this study adds to the small but growing body of research on the subject of triage and impanelment, and is especially important as it deals with the problem of extending triage into an appointment setting. Although triage has been used for a number of years in emergency rooms and walk-in clinics, its use in an outpatient clinic with an appointment system is a very recent development. The promise of increased productivity which this new method affords is especially attractive in this era of rising costs, personnel shortages, and budget cuts. Furthermore, although numerous studies of patient flow systems have been conducted, the number done in a military setting such as this is relatively small (24, 41, 80, 82, 104, 109, 120, 121, 122, 134).

From a more practical standpoint, this research will be of concrete value to the administrators of the Williams AFB Hospital. Since this is a new system, they are concerned about its effectiveness and are committed to serious consideration of the recommendations made in this report.

Finally, an examination of this report suggests a number of areas that might merit further study. The most obvious of these, of course, would be to implement and then evaluate the proposed changes. Along with this, although general studies have already been performed

comparing the overall effectiveness of various triage agents, a study specific to this clinic or to a military setting might also be done. Other possibilities might be to perform a more detailed analysis of the effect of waiting time on patient satisfaction, to study the effect of using a modified wave appointment system for the general practice clinic as a whole, or to compare the effectiveness of triage done by telephone to face-to-face triage. But whatever studies are done, it is certain that questions of provider productivity, patient flow, and patient satisfaction will always be of interest and use to hospital administrators, both in and out of the military.

BIBLIOGRAPHY

1. Albin, Susan L. et al. "Evaluation of Emergency Room Triage Performed by Nurses." American Journal of Public Health Vol. 65 No. 10 (October 1975): 1063-1068.

2. Allen, A. B. et al. "A Study of Waiting Time in an Emergency Department." Canadian Medical Association Journal Vol. 109 No. 5 (September 1, 1973): 373-376.

3. Alpert, Joel J. "Broken Appointments." Pediatrics Vol. 34 No. 1 (July 1964): 127-132.

4. Ambuel, J. Philip et al. "Urgency as a Factor in Clinic Attendance." American Journal of Diseases of Children Vol. 108 No. 4 (October 1964): 394-398.

5. "Appointments Fail to Shorten Clinic Waiting Time: Study." Hospitals Vol. 49 No. 3 (February 1, 1975): 184.

6. Bailey, Norman T. J. "A Note on Equalizing the Mean Waiting Times of Successive Customers in a Finite Queue." Journal of the Royal Statistical Society Series B Vol. 17 No. 2 (1955): 262-263.

7. Bailey, Norman T. J. "A Study of Queues and Appointment Systems in Hospital Out-Patient Departments, with Special Reference to Waiting-Times." Journal of the Royal Statistical Society Series B Vol. 14 No. 2 (1952): 185-199.

8. Bailey, Norman T. J. "Queuing for Medical Care." Applied Statistics Vol. 3 No. 3 (November 1954): 137-145.

9. Barnard, Chester I. The Functions of the Executive. Cambridge, Mass.: Harvard University Press, 1938.

10. Bedworth, David D. Industrial Systems: Planning, Analysis, Control. New York: Ronald Press, 1973.

11. Berkowitz, Allen. Operational Decisions in Outpatient Clinics. Doctoral Dissertation, The Johns Hopkins University, 1974.

12. Canter, Eric W. "Timely Cure for Scheduling Ills." Industrial Engineering Vol. 8 No. 9 (September 1976): 36-39.

13. Christoffel, J. D. and Loewenthal, Martha. "Evaluating the Quality of Ambulatory Health Care: A Review of Emerging Methods." Medical Care Vol. 15 No. 11 (November 1977): 877-897.

14. Conomikes, George S. "Improved Appointment Scheduling and Patient Flow Techniques." The Ohio State Medical Journal Vol. 74 (June 1978): 358-359.

15. Cronkhite, Jr., Leonard W. "Computer Brings Order to Clinic Scheduling System." Hospitals Vol. 43 No. 8 (April 16, 1969): 55-57.

16. Day, Lewis R., Egli, Rosemary, and Silver, Henry K. "Acceptance of Pediatric Nurse Practitioners." American Journal of Diseases of Children Vol. 119 No. 3 (March 1970): 204-208.

17. DeAngelis, Catherine and McHugh, Margaret. "The Effectiveness of Various Health Personnel as Triage Agents." Journal of Community Health Vol. 2 No. 4 (Summer 1977): 268-277.

18. Donabedian, Avedis. "Promoting Quality through Evaluating the Process of Patient Care." Medical Care Vol. 6 No. 3 (May-June 1968): 181-202.

19. Duffey, Ruth. "Computerized Central Scheduling of Patient. Appointments." Dimensions in Health Service Vol. 53 No. 9 (September 1976): 33-34.

20. Duffey, Ruth. "How to Reduce the 'No-Show' Rate." Dimensions in Health Service Vol. 55 No. 2 (February 1978): 28-29.

21. Fetter, R. B. and Thompson, J. D. "Patients' Waiting Time and Doctors' Idle Time in the Outpatient Setting." Health Services Research Vol. 1 No. 1 (Summer 1966): 66-90.

22. Fetter, R. B. and Thompson, J. D. "The Simulation of Hospital Systems." Operations Research Vol. 13 No. 5 (September-October 1965): 689-711.

23. Finch, P. D. "Deterministic Customer Impatience in the Queuing System GI/M/1." Biometrika Vol. 47 No. 1 and 2 (1960): 45-52.

24. Fitterer, J. D. and Cochrane, Charles R. "Maintaining Ambulatory Patient Care in the Army: A Study Utilizing Physician Assistants." Military Medicine Vol. 142 No. 12 (December 1977): 951-954.

25. Fletcher, Suzanne W., Appel, Francis A., and Bourgois, Michele. "Improving Emergency-Room Patient Follow-Up in a Metropolitan Teaching Hospital." The New England Journal of Medicine Vol. 291 No. 8 (August 22, 1974): 385-388.

26. Fry, John et al. "Appointments in General Practice: Doctors' and Patients' Views." The Lancet Vol. II for 1963 No. 7304 (August 24, 1963): 397-398.

27. Galton, Robert. The "Nurse Clinician Coordinator": A Study of an Expanded Role for Nurses in Ambulatory Care. Doctoral Dissertation, Columbia University, 1974.

28. Garfield, Sidney R. "Multiphasic Health Testing and Medical Care as a Right." The New England Journal of Medicine Vol. 283 No. 20 (November 12, 1970): 1087-1089.

29. Garfield, Sidney R. et al. "Evaluation of an Ambulatory Medical-Care Delivery System." The New England Journal of Medicine Vol. 294 No. 8 (February 19, 1976): 426-431.

30. Gates, Susan J. and Colborn, D. Kathleen. "Lowering Appointment Failures in a Neighborhood Health Center." Medical Care Vol. 14 No. 3 (March 1976): 263-267.

31. Gibbons, Jean Dickinson. Nonparametric Methods for Quantitative Analysis. New York: Holt, Rinehart and Winston, 1976.

32. Glenn, John Kenneth. Productivity of Ambulatory Care Delivery Systems. Doctoral Dissertation, University of Missouri at Columbia, 1974.

33. Gonnella, Joseph S. and Goran, Michael J. "Quality of Patient Care--A Measurement of Change: The Staging Concept." Medical Care Vol. 13 No. 6 (June 1975): 467-473.

34. Gonnella, Joseph S. et al. "Evaluation of Patient Care: An Approach." Journal of the American Medical Association Vol. 214 No. 11 (December 14, 1970): 2040-2043.

35. Gonnella, Joseph S., Louis, Daniel Z., and McCord, John J. "The Staging Concept--An Approach to the Assessment of Outcome of Ambulatory Care." Medical Care Vol. 14 No. 1 (January 1976): 13-21.

36. Hagerman, Gordon A. "Testing the Mailed Appointment Reminder in Family Practice." The Journal of Family Practice Vol. 7 No. 1 (July 1978): 199-201.

37. Hertz, Philip and Stamps, Paula L. "Appointment-Keeping Behavior Re-Evaluated." American Journal of Public Health Vol. 67 No. 11 (November, 1977): 1033-1036.

38. Herzog, Eric L. "The Underutilization of Nurse Practitioners in Ambulatory Care." Nurse Practitioner Vol. 2 No. 1 (September-October 1976): 26-29.

39. Hofmann, Paul B. and Rockart, John F. "Implications of the No-Show Rate for Scheduling OPD Appointments." Hospital Progress Vol. 50 No. 8 (August 1969): 35-40.

40. Hofmann, Paul B., Rockart, John F., and Barnett, G. Octo. "Planning for an Automated Clinic Appointment System." Hospital Topics Vol. 48 No. 10 (October 1970): 37, 40, 42, 62.

41. Hollison, Robert V., Vazquez, Angel M., and Warner, Dolores H. "A Medical Information System for Ambulatory Care, Research, and Curriculum in an Army Family Practice Residency: 51,113 Patient Problems." The Journal of Family Practice Vol. 7 No. 4 (October 1978): 787-795.

42. Hurtado, Arnold V. et al. "Unscheduled Use of Ambulatory Care Services." Medical Care Vol. 12 No. 6 (June 1974): 498-511.

43. Hurtado, Arnold V., Greenlick, Merwyn R., and Colombo, Theodore J. "Determinants of Medical Care Utilization: Failure to Keep Appointments." Medical Care Vol. 11 No. 3 (May-June 1973): 189-198.

44. Ittig, Peter Thomas. Planning Ambulatory Health Care Delivery Systems. Ithaca, New York: Center for Urban Development Research, 1974.

45. Jackson, R. R. P., Welch, J. D., and Fry, John. "Appointment Systems in Hospitals and General Practice." Operational Research Quarterly Vol. 15 No. 3 (September 1964): 219-237.

46. Jessiman, Andrew G. and Erat, Kathryn. "Automated Appointment System to Facilitate Medical-Care Management." Medical Care Vol. 8 No. 3 (May-June 1970): 234-246.

47. Johnson, Everett A. "How Hospitals Can Increase M.D. Productivity." Modern Hospital Vol. 112 No. 6 (June 1969): 82-86.

48. Johnson, Walter L. and Rosenfeld, Leonard S. "Factors Affecting Waiting Time in Ambulatory Care Services." Health Services Research Vol. 3 No. 4 (Winter 1968): 286-295.

49. Johnson, Walter L. and Rosenfeld, Leonard S. "Indices of Performance in Ambulatory Care Service." Medical Care Vol. 7 No. 3 (May-June 1969): 250-260.

50. Jonas, Steven. "Appointment-Breaking in a General Medical Clinic." Medical Care Vol. 9 No. 1 (January-February 1971): 82-88.

51. Jonas, Steven. "Influence of the Weather on Appointment-Breaking in a General Medical Clinic." Medical Care Vol. 11 No. 1 (January-February 1973): 72-74.

52. Jonas, Steven et al. Health Care Delivery in the United States. New York: Springer Publishing Co., 1977.

53. Kilpatrick, William. "Central Scheduling of Patient Appointments." Dimensions in Health Service Vol.53 No. 3 (March 1976): 32-33.

54. Komaroff, Anthony L. et al. "Protocols for Physician Assistants: Management of Diabetes and Hypertension." The New England Journal of Medicine Vol. 290 No. 6 (February 7, 1974): 307-312.

55. Lane, Dorothy S. "The Diagnosis and Management of the Walk-In Syndrome." American Journal of Public Health Vol. 64 No. 9 (September 1974): 908-910.

56. Lane, Walter. "The Best Possible Way to Schedule Appointments." Medical Economics Vol. 53 No. 6 (March 22, 1976): 223-235.

57. Lee, Sidney S., Solon, Jerry A., and Sheps, Cecil G. "How New Patterns of Medical Care Affect the Emergency Unit." The Modern Hospital Vol. 94 No. 5 (May 1960): 97-101.

58. Levy, Rona and Claravall, Viqui. "Differential Effects of a Phone Reminder on Appointment Keeping for Patients with Long and Short Between-Visit Intervals." Medical Care Vol. 15 No. 5 (May 1977): 435-438.

59. Lewis, Charles E. and Cheyovich, Therese K. "The Clinical Trial as a Means for Organizational Change: Report of a Case Study." Medical Care Vol. 14 No. 2 (February 1976): 137-145.

60. Lewis, Charles E. and Cheyovich, Therese K. "Who is a Nurse Practitioner? Processes of Care and Patients' and Physicians' Perceptions." Medical Care Vol. 14 No. 4 (April 1976): 365-371.

61. Lewis, Charles E. and Linn, Lawrence S. "The Content of Care Provided by Family Nurse Practitioners." Journal of Community Health Vol. 2 No. 4 (Summer 1977): 259-267.

62. Lewis, Charles E. and Resnick, Barbara A. "Nurse Clinics and Progressive Ambulatory Patient Care." The New England Journal of Medicine Vol. 277 No. 23 (December 7, 1967): 1236-1241.

63. Lewis, Charles E. et al. "Activities, Events, and Outcomes in Ambulatory Patient Care." The New England Journal of Medicine Vol. 280 No. 12 (March 20, 1969): 645-649.

64. Lewis, P. A. W. "A Computer Program for the Statistical Analysis of Series of Events." IBM Systems Journal Vol. 5 No. 4 (1966): 202-225.

65. Lindstrom, Carol J. "No Shows: A Problem in Health Care." Nursing Outlook Vol. 23 No. 12 (December 1975): 755-759.

66. Linn, Lawrence S. "Patient Acceptance of the Family Nurse Practitioner." Medical Care Vol. 14 No. 4 (April 1976): 357-364.

67. Lockerby, Florence K. "Nurses' Roles Expanded." Hospitals Vol. 45 No. 24 (December 16, 1971): 92-98.

68. Madden, Edward E. "A Manual Centralized Outpatient Appointment System." Hospital Topics Vol. 54 No. 3 (May-June 1976): 48-52.

69. Marshall, Gordon M. ed. "The Role of the Pediatric Nurse Associate." Hospital Topics Vol. 54 No. 3 (May-June 1976): 38-39.

70. Mechaber, Judith, McNerney, Helen, and Charney, Evan. "Analysis of the Triage System in a Neighborhood Health Center." Journal of Nursing Administration Vol. 4 No. 6 (November-December 1974): 29-32.

71. Merenstein, Joel H., Wolfe, Harvey and Barker, Kathleen. "The Use of Nurse Practitioners in a General Practice." Medical Care Vol. 12 No. 5 (May 1974): 445-452.

72. Miller, Irwin and Freund, John E. Probability and Statistics for Engineers. 2nd ed. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1977.

73. Mills, John. "Effectiveness of Nurse Triage in the Emergency Department of an Urban County Hospital." Journal of the American College of Emergency Physicians Vol. 5 No. 11 (November 1976): 877-882.

74. Nazarian, Lawrence F. et al. "Effect of a Mailed Appointment Reminder on Appointment Keeping." Pediatrics Vol. 53 No. 3 (March 1974): 349-352.

75. Nelson, Eugene C., Jacobs, Arthur R., and Johnson, Kenneth G. "Patient's Acceptance of Physician's Assistants." Journal of the American Medical Association Vol. 228 No. 1 (April 1, 1974): 63-67.

76. Neuhoff, Carl F. "Outreach Clinic Experiment Extends Care with Paramedics." Hospitals Vol. 51 No. 1 (January 1, 1977): 77-80.

77. Nuffield Provincial Hospitals Trust. Waiting in Outpatient Departments: A Survey of Outpatient Appointment Systems. London: Oxford University Press, 1965.

78. Orden, Susan R. et al. "Physician and Patient Assessment of Ambulatory Care in a University Facility." Journal of Community Health Vol. 4 No. 1 (Fall 1978): 23-32.

79. Panico, Joseph A. Queuing Theory: A Study of Waiting Lines for Business, Economics, and Science. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1969.

80. Paulson, Isabel S. "A Mechanized Appointment System for Out-patient Clinics." Hospitals Vol. 40 No. 18 (September 16, 1966): 80-88.

81. Payne, Beverly C. "Continued Evolution of a System of Medical Care Appraisal." Journal of the American Medical Association Vol. 201 No. 7 (August 14, 1967): 536-540.

82. Perry, Henry B. "A Comparison of Military and Civilian Physician Assistants." Military Medicine Vol. 143 No. 11 (November 1978): 763-767.

83. Ratzer, G. et al. "Mini-Computer-Based Appointment Scheduling for Ambulatory Patients." Methods of Information in Medicine Vol. 17 No. 3 (July 1978): 167-172.

84. Reisman, Arnold, DaSilva, Joao Mello, and Mantell, Joseph B. "Systems and Procedures of Patients and Information Flow." Hospital and Health Services Administration Vol. 23 No. 1 (Winter 1978): 42-71.

85. Riedel, Donald C. ed. "Comment on 'An Approach to Reducing the Adverse Effects of Broken Appointments in Primary Care Systems.'" Medical Care Vol. 16 No. 6 (June 1978): 528-530.

86. Rising, Edward J. Ambulatory Care Systems: Volume I Design for Improved Patient Flow. Lexington, Mass.: D. C. Heath & Co., 1977.

87. Rising, Edward J., Baron, Robert, and Averill, Barry. "A Systems Analysis of a University-Health-Service-Outpatient Clinic." Operations Research Vol. 21 No. 5 (September-October 1973): 1030-1047.

88. Rockart, John F. "A New Look at Clinical Schedules." Technology Review Vol. 73 No. 2 (December 1970): 34-39.

89. Rockart, John F. and Herzog, Eric L. "A Predictive Model for Ambulatory Patient Service Time." Medical Care Vol. 12 No. 6 (June 1974): 512-519.

90. Rockart, John F. and Hofmann, Paul B. "Physician and Patient Behavior under Different Scheduling Systems in a Hospital Outpatient Department." Medical Care Vol. 7 No. 6 (November-December 1969): 463-470.

91. Rosenblut, Alan et al. "OPD Waiting Time Reduced by Use of an Individual Appointment System." Hospital Topics Vol. 50 No. 3 (March 1972): 48-52.

92. Rosser, James M. and Mossberg, Howard E. An Analysis of Health Care Delivery. New York: John Wiley & Sons, 1977.

93. Rousseau, Jean-Marc and Laporte, Gilbert. "A Practical Optimisation Technique for a Queuing System." Operational Research Quarterly Vol. 28 No. 1 (1977): 33-35.

94. Russo, Raymond M., Allen, John E., and Gururaj, Vymutt J. "Outpatient Management of the Severely Ill Child: A Timed Priority System." American Journal of Diseases of Children Vol. 124 No. 2 (August 1972): 235-239.

95. Russo, Raymond M. et al. "Triage Abilities of Nurse Practitioner vs. Pediatrician." American Journal of Diseases of Children. Vol. 129 No. 6 (June 1975): 673-675.

96. Schofferman, Jerome et al. "Use of the Telephone for Short-Term Follow-Up." Medical Care Vol. 15 No. 5 (May 1977): 430-434.

97. Schroeder, Steven A. "Lowering Broken Appointment Rates at a Medical Clinic." Medical Care Vol. 11 No. 1 (January-February 1973): 75-78.

98. Schroer, Bernard J. and Smith, Herbert T. "Effective Patient Scheduling." The Journal of Family Practice Vol. 5 No. 3 (September 1977): 407-411.

99. Schulman, John Jr., and Wood, Carol. "Experience of a Nurse Practitioner in a General Medical Clinic." Journal of the American Medical Association Vol. 219 No. 11 (March 13, 1972): 1453-1461.

100. Schwartzman, Gordon. "The Patient Arrival Process in Hospitals: Statistical Analysis." Health Services Research Vol. 5 No. 4 (Winter 1970): 320-329.

101. Shah, Chandrakant P., MacBride, James R., and Lamb, George A. "Appointment Systems: Why Does a Patient Not Return?" Canadian Journal of Public Health Vol. 68 No. 2 (March-April 1977): 148-153.

102. Shepard, Donald S. and Moseley, Thomas A. "Mailed Versus Telephone Appointment Reminders to Reduce Broken Appointments in a Hospital Outpatient Department." Medical Care Vol. 14 No. 3 (March 1976): 268-273.

103. Sherman, Jacques L. Jr. and Fields, Sylvia Kleiman. Guide to Patient Evaluation. Flushing, New York: Medical Examination Publishing Co., Inc., 1974.

104. Shields, Charles et al. "Analysis of Patient Load in a Military Outpatient Clinic." Military Medicine Vol. 141 No. 7 (July 1976): 459-460, 467.

105. Shmarak, Kenneth L. "Reduce Your Broken Appointment Rate: How One Children and Youth Project Reduced Its Broken Appointment Rate." American Journal of Public Health Vol. 61 No. 12 (December 1971): 2400-2409.

106. Shonick, William and Klein, Bonnie W. "An Approach to Reducing the Adverse Effects of Broken Appointments in Primary Care Systems." Medical Care Vol. 15 No. 5 (May 1977): 419-429.

107. Silver, Henry K., Ford, Loretta C., and Ray, Lewis R. "The Pediatric Nurse-Practitioner Program." Journal of the American Medical Association Vol. 204 No. 4 (April 22, 1968): 298-302.

108. Singer, Mark E., Rossfeld, John E., and VanHall, Michael C. "Centralized Appointment System Reduces Patients Waiting Time." Hospitals Vol. 50 No. 6 (March 16, 1976): 151-158.

109. Slay, Larry E. and Riskin, Wayne G. "Algorithm-Directed Triage in an Emergency Department." Journal of the American College of Physicians Vol. 5 No. 11 (November 1976): 869-876.

110. Smalley, Harold E. and Freeman, John R. Hospital Industrial Engineering. New York: Reinhold Publishing Corp., 1966.

111. Soriano, A. "Comparison of Two Scheduling Systems." Operations Research Vol. 14 No. 3 (May-June 1966): 388-397.

112. Sox, Harold C., Sox, Carol H., and Tompkins, Richard K. "The Training of Physician's Assistants: The Use of a Clinical Algorithm System for Patient Care, Audit of Performance and Education." The New England Journal of Medicine Vol. 288 No. 16 (April 19, 1973): 818-824.

113. Sparkes, Paul. "Is Inconvenience to the Patient Really Necessary?" Canadian Medical Association Journal Vol. 112 No. 2 (January 25, 1975): 227.

114. Spector, Reynold et al. "Medical Care by Nurses in an Internal Medicine Clinic." Journal of the American Medical Association Vol. 232 No. 12 (June 23, 1975): 1234-1237.

115. Spitzer, Walter O. et al. "The Burlington Randomized Trial of the Nurse Practitioner." The New England Journal of Medicine Vol. 290 No. 5 (January 31, 1974): 251-256.

116. Stamps, Paula L. Ambulatory Care Systems: Volume III Evalua-tion of Outpatient Facilities. Lexington, Mass.: D. C. Heath & Co.,

Stanley, Linda. "Expanded-role Nursing Hits the Hospitals." (October 1978): 55-59.

118. Steinwachs, Donald M. "The Role of New Health Practitioners in a Prepaid Group Practice: Changes in the Distribution of Ambulatory Care Between Physician and Nonphysician Providers of Care." Medical Care Vol. 14 No. 2 (February 1976): 95-120.

119. Stine, Oscar C. et al. "Broken Appointments at a Comprehensive Clinic for Children." Medical Care Vol. 6 No. 4 (July-August 1968): 332-339.

120. Stuart, Richard B. "Centralized Outpatient Appointment Systems: Delivering Ambulatory Care More Efficiently in Multi-Specialty Clinics." Military Medicine Vol. 141 No. 6 (June 1976): 392-394.

121. Stuart, Richard B., Peterson, Arnold G., and Fairfield, Louis D. "A Comparative Study of Patient Scheduling Systems for Army Sick Call." Military Medicine Vol. 141 No. 1 (January 1976): 39-40.

122. U. S. Department of Defense. Report of the Military Health Care Study. Washington: U.S. Government Printing Office, 1975.

123. U. S. Department of Health, Education, and Welfare. Report of the Physician Extender Workshop June 1977. Washington: U.S. Government Printing Office, 1977.

124. Vallbona, C. et al. "Computer Support of Medical Decisions in Ambulatory Care." Methods of Information in Medicine Vol. 14 No. 2 (April 1975): 55-72.

125. Vickery, Donald M., M.D. Triage: Problem Oriented Sorting of Patients. Bowie, Maryland: Robert J. Brady Co., 1975.

126. Vickery, Donald M. et al. "Physician Extenders in Walk-In Clinics." Archives of Internal Medicine Vol. 135 No. 5 (May 1975): 720-725.

127. Voltmann, John D. "Jamestown Medical Clinic System." Journal of the American Medical Association Vol. 234 No. 3 (October 20, 1975): 303-304.

128. Weinerman, E. Richard and Edwards, Herbert R. "'Triage' System Shows Promise in Management of Emergency Department Load." Hospitals Vol. 38 No. 22 (November 16, 1964): 55-62.

129. Weinerman, E. Richard et al. "Yale Studies in Ambulatory Medical Care v. Determinants of Use of Hospital Emergency Services." American Journal of Public Health Vol. 56 No. 7 (July 1966): 1037-1056.

130. Weinerman, E. Richard, Rutzen, S. Robert, and Pearson, David A. "Effects of Medical 'Triage' in Hospital Emergency Service." Public Health Reports Vol. 80 No. 5 (May 1965): 389-399.

131. Welch, J. D. and Bailey, Norman T. J. "Appointment Systems in Hospital Outpatient Departments." The Lancet Vol. I for 1952 No. 6718 (May 31, 1952): 1105-1108.

132. Wesp, Joseph E., Brigadier General, USAF, MC. "A System for Assessing Primary Health Care Delivery." Letter to all ATC Medical Facility Commanders, May 31, 1979.

133. White, M. J. B. and Pike, M. C. "Appointment Systems in Out-Patients' Clinics and the Effect of Patients' Unpunctuality." Medical Care Vol. 2 No. 3 (July-September 1964): 133-144.

134. Willis, John C. and Bristow, Charles L. "Appointment Systems—An Overview." Medical Service Digest Vol. 28 No. 3 (Summer 1977): 29-32.

135. World Health Organization. World Health (June 1972): 1-35.

136. Yaffe, Richard and Zalkind, David, eds. Evaluation in Health Services Delivery: Proceedings of an Engineering Foundation Conference. South Berwick, Maine: Engineering Foundation Conferences, August 19-24, 1973.

137. Zilm, Frank et al. "Ambulatory Care Survey Paves Way to the Future." Hospitals Vol. 52 No. 11 (June 1, 1978): 79-83.

138. Anderson, Mary R. professional statistician. Informal interview, Arizona State University, October 24, 1979.

APPENDIX 1

SAMPLE INDIVIDUAL APPOINTMENT SCHEDULES

DAILY APPOINTMENT REGISTER

DAILY APPOINTMENT REGISTER

15 Minute Schedule

APPENDIX 2

SAMPLE TRIAGE APPOINTMENT SCHEDULE

Name/SSAN/Status/Phone	Appt Time	Appt Time	Name/SSAN/Status/Phone	
	0830	1300		
	"	"		
	"	"		
	"	"		
	0845	1330		
	"	"		
	"	"		
	"	"		
	0930	1400		
	"	"		
	"	"		
	"	"		
	0945	1430		
	"	"		
	"	"		
	"	"		
	1030	"		
	"	ER		
	"	ER		
	"	ER		
	"	ER		
	"			
	"			
1100		1100		
1100		1100		
1540		1540		
1540		1540		

AF FORM SEP 77 3126   GENERAL PURPOSE (8" X 10½")   * U.S. G.P.O. 781-301/1374

APPENDIX 3

QUESTIONNAIRE A DATA

Individual Appointments

Appt. Time	Arrival Time	Provider	Provider Service Time	Total Service Time
----	0945	PA	15	30
----	0805	P	25	80
----	0750	PA	05	50
----	0824	PA	10	--
----	0750	P	05	145
----	0915	PA	10	25
----	0920	P	10	20
----	1500	PA	20	45
1115	1050	P	10	50
1130	1050	P	07	60
0815	0805	P	14	31
0930	0950	PA	--	--
0815	0805	PA	17	42
1430	1340	PA	05	45
0800	0810	PA	15	20
1415	1400	--	--	--
1345	1300	P ·	--	--
1130	1120	--	--	--
1100	1045	--	--	--
0830	0810	--	--	--
1515	1500	PA	05	15
1145	1115	--	--	--
1115	1100	--	--	--
1100	1100	PA	10	20
1045	1040	--	--	--
1030	1020	PA	05	25
0945	0900	PA	05	25
0830	0820	PA	22	35
1415	1410	PA	05	15
1400	1350	PA	20	30
1345	1320	PA	10	25
1100	1045	PA	15	30
1045	0915	PA	--	75
1000	0950	PA	10	20
0900	0900	PA	20	25
0915	0900	PA	05	35
1030	1015	PA	10	25
1045	1035	PA	20	35
1100	1105	PA	--	--
1115	1100	PA	06	16
1130	1120	PA	06	16
1145	1135	PA	15	25
1400	1345	PA	15	24
1530	1531	PA	11	14
----	1530	PA	10	40
0930	0910	P	06	26

Individual Appointments Cont.

Appt. Time	Arrival Time	Provider	Provider Service Time	Total Service Time
0945	0935	P	10	25
1000	0950	P	--	--
1030	1015	P	10	40
1130	1125	P	--	--
1515	1510	P	20	25
1530	1520	P	05	25
1545	1540	P	10	20
0900	0845	P	15	30
0945	0915	P	10	30
1045	1025	P	20	55
1400	1400	P	05	15
1500	1445	P	15	60
1515	1500	P	20	70
1545	1529	P	15	45
----	0938	PA	13	67
----	1025	P	20	25
----	1425	P	20	85
----	0845	P	15	30
----	1330	--	05	60
----	0915	PA	05	20
----	1000	--	20	105
----	1345	P	15	95
----	0854	P	10	91
----	1545	PA	05	35
----	0845	P	10	30
0815	0811	P	05	59
----	0800	P	07	52
0900	0845	P	--	--
0930	0915	P	15	30
0945	0945	P	15	30
1030	1025	P	01	16
1100	1050	P	02	12
1415	1400	P	04	18
1515	1500	P	15	25
0815	0745	P	15	55
1330	1311	P	09	22
1345	1330	P	25	55
0815	0800	PA	10	25
0930	0925	PA	01	10
1000	0950	PA	15	20
1100	1040	PA	--	--
1115	1110	PA	10	50
1130	1055	PA	08	53
1315	1300	PA	45	135
1400	1145	PA	10	143
1530	1515	PA	05	15
0900	0900	PA	10	20

Individual Appointments Cont.

Appt. Time	Arrival Time	Provider	Provider Service Time	Total Service Time
1115	1055	PA	10	20
1130	1100	PA	13	25
0815	0805	PA	05	25
1315	1310	PA	25	45
1300	1305	P	15	45
1315	1300	P	25	60
1330	1320	P	15	40
0915	0900	PA	15	30
1330	1325	P	06	91
1000	0930	P	07	37
0915	0915	P	30	40
0900	0815	P	03	13
----	0805	PA	08	23
----	0815	PA	17	50
----	1025	--	15	20
----	1515	P	10	15
1315	1315	P	10	25
1545	1540	P	10	18
1500	1446	PA	--	--
1330	1315	P	15	30
1500	1425	P	15	25
1400	1400	P	--	--
1400	1400	P	20	50
----	1315	PA	39	114
1345	1330	P	03	20
----	1450	--	13	13
----	1530	P	10	50
0845	0700	PA	20	50
0915	0855	PA	05	15
0945	0930	PA	10	15
1000	0950	PA	07	18
1030	1025	PA	10	15
1100	----	PA	05	--
1130	1107	PA	15	28
1145	1125	PA	10	10
1415	1415	--	--	--
1115	1105	--	--	--
----	1315	P	15	60
----	0745	P	20	45
----	0950	PA	30	30
----	1455	PA	05	20

Panel Appointments

Appt. Time	Arrival Time	Provider	Provider Service Time	Total Service Time
0830	0825	P	13	60
0845	0825	P	02	85
0945	0935	P	05	70
1030	1000	P	10	50
0930	0900	PA	10	40
0945	0915	PA	05	20
0930	0925	PA	15	35
1030	1010	PA	10	40
0930	0915	PA	10	40
0930	0925	PA	05	45
0845	0800	--	--	--
----	0710	--	10	--
0845	0835	P	05	75
1430	1430	P	10	65
----	1325	P	--	--
----	1337	PA	--	--
----	1255	P	05	80
----	0935	--	10	100
----	1420	P	--	--
1300	1230	PA	05	95
1030	1010	PA	--	--
1030	1035	PA	05	70
1400	1346	P	20	84
1300	1230	P	05	145
0845	0845	PA	05	148
0830	0810	P	10	60
0830	0815	P	10	85
1330	1317	P	27	85
1030	1015	PA	06	75
0930	0900	PA	07	45
1400	1350	PA	10	60
0930	----	PA	05	--
1400	1300	--	01	65
1430	1400	P	20	125
0845	0830	PA	15	45
0930	0920	PA	10	50
1300	1230	PA	03	92
1030	0920	PA	05	15
1030	1025	--	02	08

APPENDIX 4

QUESTIONNAIRE A ANALYSIS

Provider Service Time

Frequency Distribution Histograms

Frequency

n = 116
$\bar{x} = 12.45$

Provider Service Times--Appointment

Frequency

n = 31
$\bar{x} = 8.55$

Provider Service Times--Panel

Total Service Time

Frequency Distribution Histograms

n = 114
$\bar{x}$ = 37.49

Total Service Times--Appointment

n = 31
$\bar{x}$ = 68.29
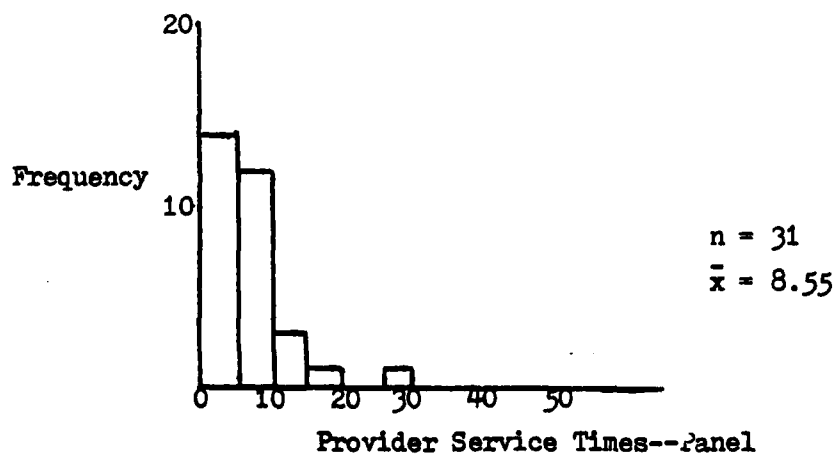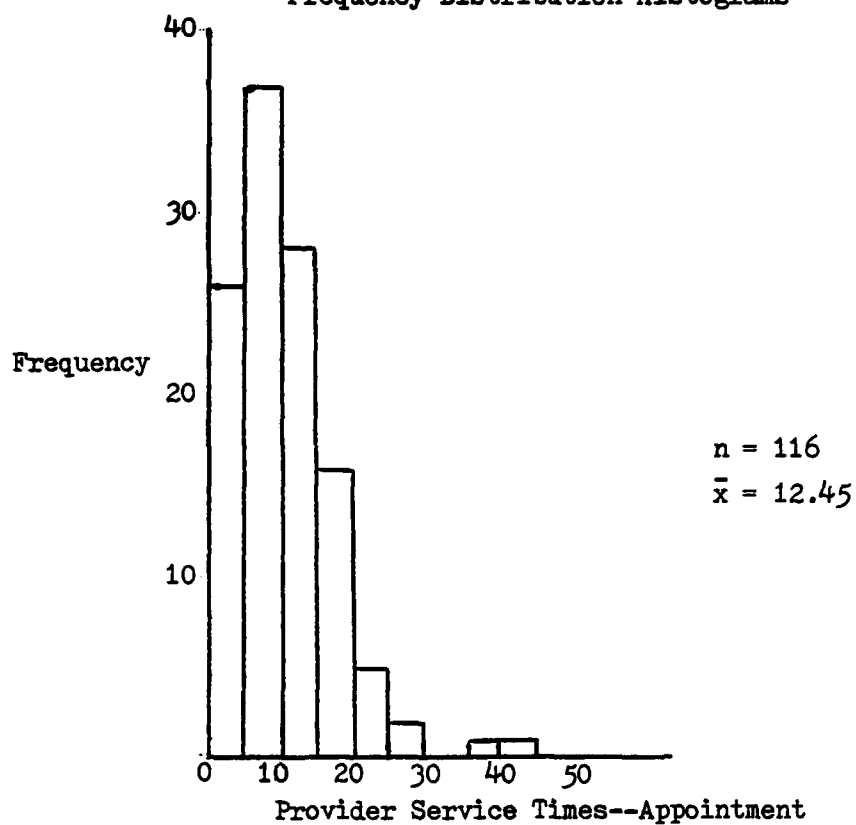
Total Service Times--Panel
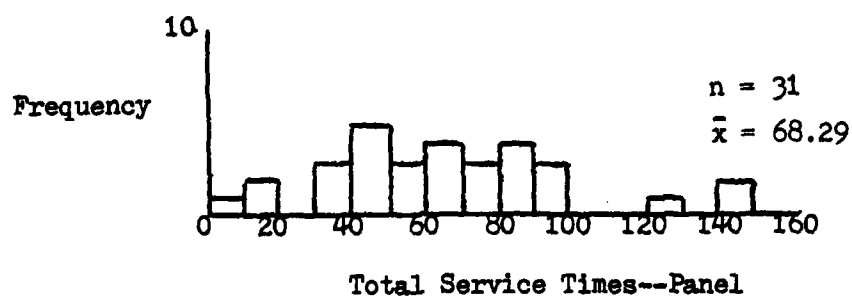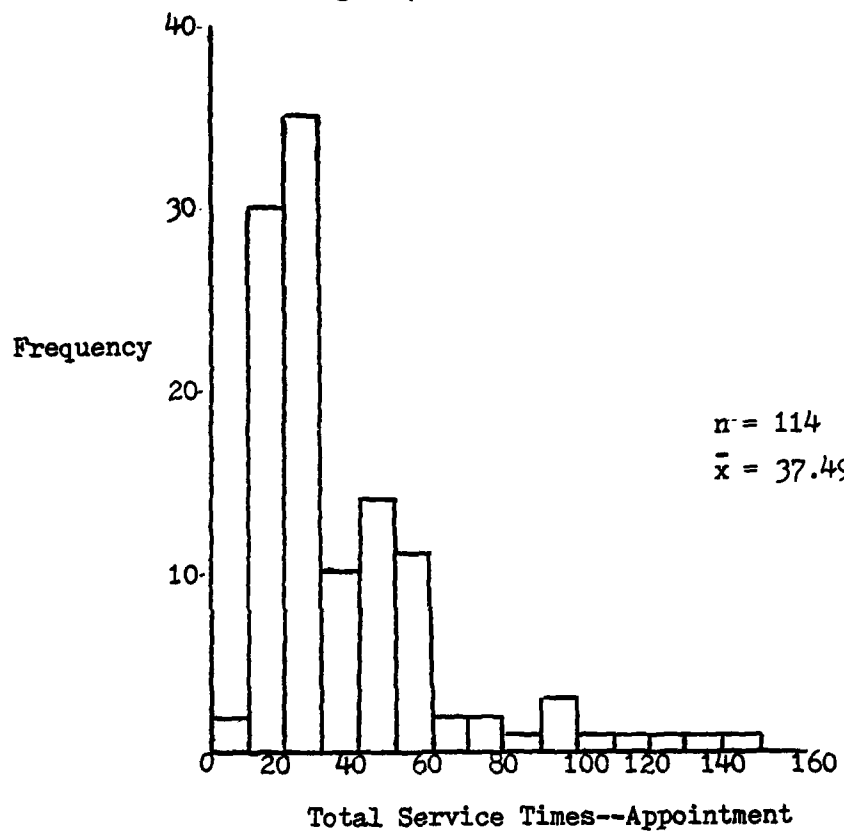
The differences in the median service times and arrival times are tested for significance using the Mann-Whitney-Wilcoxon Test.

The test statistic is calculated using the formula:

$$Z_{x,L} = \frac{T_x + .5 - m(N + 1)/2}{\sqrt{\frac{mn}{12N(N-1)} \left(N(N^2 - 1) - (\Sigma u^3 - \Sigma u) \right)}} \quad *$$

$$Z_{x,R} = \frac{T_x - .5 - m(N + 1)/2}{\sqrt{\frac{mn}{12N(N-1)} \left(N(N^2 - 1) - (\Sigma u^3 - \Sigma u) \right)}} \quad *$$

For Provider Service Times:

$$m = 31 \qquad n = 116 \qquad N = 147$$

$$\Sigma u = 139 \qquad \Sigma u^3 = 97117 \qquad T_x = 1670$$

$$Z_{x,L} = -3.007 \qquad P = .0013$$

For Total Service Times:

$$m = 31 \qquad n = 114 \qquad N = 145$$

$$\Sigma u = 120 \qquad \Sigma u^3 = 12672 \qquad T_x = 3286.5$$

$$Z_{x,R} = 4.9437 \qquad P < .0002$$

For Arrival Times:

$$m = 31 \qquad n = 100 \qquad N = 131$$

$$\Sigma u = 118 \qquad \Sigma u^3 = 48226 \qquad T_x = 1782$$

$$Z_{x,L} = -1.442 \qquad P = .0746$$

* Correction factors are applied for continuity and for having a large number of ties.

The differences in the mean service times are tested using the Student-t test.

Using the test statistic:

$$Z = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}}$$

σ^2 is estimated by $s^2 = \dfrac{n\sum x^2 - (\sum x)^2}{n(n-1)}$

For Provider Service Times:

$\bar{x}_1 = 8.55$ $n_1 = 31$ $\sigma_1^2 = 28.65$

$\bar{x}_2 = 12.45$ $n_2 = 116$ $\sigma_2^2 = 54.529$

$Z = -3.303$ $P = .0005$

For Total Service Times:

$\bar{x}_1 = 68.29$ $n_1 = 31$ $\sigma_1^2 = 1103.08$

$\bar{x}_2 = 37.49$ $n_2 = 114$ $\sigma_2^2 = 641.28$

$Z = 4.798$ $P < .0002$

APPENDIX 5

QUESTIONNAIRE B DATA

CATEGORY			RATING		
	Excellent	Good	Average	Fair	Poor
A	62 (40%)	57 (37%)	28 (18%)	8 (5%)	1 (0%)
B	85 (60%)	36 (25%)	12 (8%)	5 (4%)	4 (3%)
C	72 (53%)	41 (30%)	20 (15%)	3 (2%)	0
D	59 (46%)	45 (35%)	21 (17%)	2 (2%)	0
E	68 (52%)	39 (30%)	18 (14%)	4 (3%)	2 (1%)
F	68 (52%)	37 (28%)	25 (19%)	2 (1%)	0
G	43 (28%)	49 (32%)	30 (20%)	13 (8%)	18 (12%)

CLINIC--TOTAL

CATEGORY	Excellent	Good	Average	Fair	Poor
A	59 (44%)	53 (39%)	16 (12%)	6 (4%)	1 (1%)
B	83 (65%)	35 (28%)	8 (6%)	1 (1%)	0
C	70 (58%)	38 (31%)	13 (11%)	0	0
D	57 (51%)	41 (36%)	15 (13%)	0	0
E	65 (57%)	34 (30%)	15 (13%)	1 (0%)	0
F	64 (54%)	33 (28%)	20 (17%)	1 (1%)	0
G	41 (30%)	49 (36%)	24 (18%)	11 (8%)	11 (8%)

CLINIC--SHORT WAIT

CATEGORY	Excellent	Good	Average	Fair	Poor
A	3 (14%)	4 (19%)	12 (57%)	2 (10%)	0
B	2 (13%)	1 (6%)	4 (27%)	4 (27%)	4 (27%)
C	2 (13%)	3 (20%)	7 (47%)	3 (20%)	0
D	2 (14%)	4 (29%)	6 (43%)	2 (14%)	0
E	3 (19%)	5 (31%)	3 (19%)	3 (19%)	2 (12%)
F	4 (28.5%)	4 (28.5%)	5 (36%)	1 (7%)	0
G	2 (12%)	0	6 (38%)	2 (6%)	7 (44%)

CLINIC--LONG WAIT

CATEGORY	Excellent	Good	RATING Average	Fair	Poor
A	49 (41%)	45 (37%)	18 (15%)	7 (6%)	1 (1%)
B	71 (64%)	27 (24%)	10 (9%)	1 (1%)	2 (2%)
C	57 (56%)	30 (29%)	13 (13%)	2 (2%)	0
D	46 (48%)	33 (35%)	15 (16%)	1 (1%)	0
E	53 (55%)	28 (29%)	13 (13%)	2 (2%)	1 (1%)
F	52 (53%)	27 (28%)	18 (18%)	2 (2%)	0
G	29 (24%)	40 (35%)	23 (19%)	11 (9%)	15 (13%)

INDIVIDUAL APPOINTMENTS

CATEGORY	Excellent	Good	Average	Fair	Poor
A	13 (36%)	12 (33%)	10 (28%)	1 (3%)	0
B	14 (45%)	9 (29%)	2 (6.5%)	4 (13%)	2 (6.5%)
C	15 (44%)	11 (32%)	7 (21%)	1 (3%)	0
D	13 (41%)	12 (37%)	6 (19%)	1 (3%)	0
E	15 (44%)	11 (32%)	5 (15%)	2 (6%)	1 (3%)
F	16 (49%)	10 (30%)	7 (21%)	0	0
G	14 (40%)	9 (26%)	7 (20%)	2 (6%)	3 (8%)

PANEL

CATEGORY	Excellent	Good	Average	Fair	Poor
A	33 (41%)	24 (30%)	19 (24%)	4 (5%)	0
B	46 (60%)	15 (19%)	9 (12%)	5 (6%)	2 (3%)
C	41 (53%)	22 (28%)	12 (15%)	3 (4%)	0
D	31 (48%)	21 (33%)	10 (16%)	2 (3%)	0
E	33 (52%)	15 (23%)	12 (19%)	3 (5%)	1 (1%)
F	34 (49%)	19 (28%)	14 (20%)	2 (3%)	0
G	22 (27%)	22 (27%)	17 (20%)	6 (7%)	14 (17%)

PHYSICIAN

CATEGORY	Excellent	Good	Average	Fair	Poor
A	29 (38%)	33 (44%)	9 (12%)	4 (5%)	1 (1%)
B	39 (60%)	21 (32%)	3 (5%)	0	2 (3%)
C	31 (53%)	19 (33%)	8 (14%)	0	0
D	28 (44%)	24 (38%)	11 (18%)	0	0
E	35 (52%)	24 (36%)	6 (9%)	1 (1.5%)	1 (1.5%)
F	34 (54%)	18 (29%)	11 (17%)	0	0
G	21 (29%)	27 (37%)	13 (18%)	7 (10%)	4 (6%)

PHYSICIAN ASSISTANT

APPENDIX 6

QUESTIONNAIRE B ANALYSIS

The differences in proportions are tested using the Chi-square test.

The test statistic is calculated using the formula:

$$\chi^2 = \sum \sum \frac{(f_{ij} - e_{ij})^2}{e_{ij}}$$

degrees of freedom = 1 α = .005

The hypothesis tested is that the satisfaction is the same for type of provider seen, type of appointment (panel or individual), or a long or short waiting time.

Question 4a--Overall Service

	Physician	Physician Assistant
Favorable	57	62
Unfavorable	23	14

χ^2 = 2.523 not significant

	Panel	Individual Appointment
Favorable	25	94
Unfavorable	11	26

χ^2 = .7200 not significant

	Short	Long
Favorable	112	7
Unfavorable	23	14

χ^2 = 21.60   significant

Question 4b--Service That Day

	Physician	Physician Assistant
Favorable	61	60
Unfavorable	16	5

χ^2 = 7.389 not significant for α = .005, however it is significant for α = .01

	Panel	Individual Appointment
Favorable	23	98
Unfavorable	8	13

χ^2 = 2.300 not significant

	Short	Long
Favorable	118	3
Unfavorable	9	12

χ^2 not valid if any cell has n $<$ 5

Question 4g--Appointment System

	Physician	Physician Assistant
Favorable	44	48
Unfavorable	37	24

χ^2 = 2.806 not significant

	Panel	Individual Appointment
Favorable	23	69
Unfavorable	12	49

χ^2 = .647 not significant

Question 4g--Appointment System Cont.

	Short	Long
Favorable	90	2
Unfavorable	46	15

$$\chi^2 \text{ not valid if any cell has } n < 5$$

A test was also made on whether or not there was a significant difference in satisfaction with overall service and satisfaction with the appointment system. A Z test was used, as well as the chi-square test, using the test statistic:

$$Z = \frac{\frac{x_1}{n_1} + \frac{x_2}{n_2}}{\sqrt{\hat{p}\,(1 - \hat{p})\,(\frac{1}{n_1} + \frac{1}{n_2})}} \qquad \text{where } \hat{p} = \frac{x_1 + x_2}{n_1 + n_2}$$

$$x_1 = 92 \quad x_2 = 119 \quad n_1 = 153 \quad n_2 = 156$$

$$Z = 25.762 \quad \text{significant with } P \approx 0$$

For the chi-square test:

	Appointment	Overall
Favorable	92	119
Unfavorable	61	37

$$\chi^2 = 9.028 \quad \text{significant for } \alpha = .005$$

APPENDIX 7

BROKEN APPOINTMENT RATE

The broken appointment rate was calculated using completed appointment logs from the general practice clinic. The period 1-11 October 1979 was used. An appointment was considered broken if the patient was a no-show, or if the appointment was cancelled too late to be filled by another patient.

Appointments Booked = 865

No-shows = 48

No-show rate = $\frac{48}{865}$ = 5.5%

APPENDIX 8

APPOINTMENT AVAILABILITY AND NUMBER OF PATIENTS SEEN

The average number of appointments available per provider per week was calculated by taking an average of the average number of available slots for each provider for a typical week.

	Total Avail.	Urgent	Routine
Physician #1	118	43	75
#2	123	66	57
#3	104	57	47
Physician Ass't. #1	117	64	53
#2	129	69	60
#3	123	64	59
#4	117	62	55
Avg. Physician	115	55	60
Avg. Phys. Ass't.	122	65	57

The availability of Panel appointments was calculated based on an average of 250 per week, with 50 routine appointments. The panel uses two physician assistants and one physician.

For the proposed system, the average number of appointments for each of the two providers assigned to the panel is 162 urgent appointments per week. The total appointments for the other providers will remain the same, however the number of urgents and routines will change. To calculate this, the remaining urgent appointments (based on keeping the total for the clinic the same) were allocated to the two types of providers in the same proportions used in the old system. This was then subtracted from the total available to determine the number of routine appointments.

Actual Number of Patients Seen

Hospital records were used to determine the actual number of patients seen in the general practice clinic. The total number of patients seen by each of the seven providers in the clinic was used. There were 22 duty days in January and there were 15 duty days under impanelment in September.

Month	Number of Patients Seen	Avg. Number of Days Worked per Provider	Avg. Number of Patients Seen per Provider
Jan. 1979	2764	19.5	20.2 per day
Sept. 1979	1487	12.6	16.9 per day

APPENDIX 9

SAMPLE QUESTIONNAIRES

To the patient:

The purpose of this survey is to determine the effectiveness of the appointment system at this hospital. Although I am conducting it to fulfill part of the requirements for a Masters Degree from Arizona State University, Col. Moore, the Hospital Commander, has given me his support and will receive a copy of my final report. Please answer all questions as accurately as possible, so that the results can be used to improve the service you receive here. Disclosure of the last four of the sponsor's SSAN is voluntary, but is needed for correlating data. All questionnaires are strictly confidential. Thank you for your cooperation.

JOHN W. KOCH, Capt, USAF
AFIT Sponsored Graduate Student

QUESTIONNAIRE A   P   A

1. Last four numbers of sponsor's SSAN. _____

2. What time did you arrive at the clinic? _____

3. When did you call for your appointment? (circle one)
   today   yesterday   2-5 days ago   6-10 days ago   more than 10 days ago

4. If you called for your appointment today, what time did you call? _____

5. Is this a follow-up appointment?   YES   NO   (circle one)

6. What time were you seen by the screener or medical technician? _____

7. After you were seen by the screener or medical technician, were you then
   seen by a: doctor, physician assistant, or nurse practitioner?   (circle one)
        Time you were called into the office. _____
        Time you left the office. _____

8. Were lab tests ordered prior to being seen?   YES   NO   (circle one)

9. Were more tests ordered after being seen?   YES   NO   (circle one)
   If YES, did you have to wait for the results, and then be seen again the
   same day?   YES   NO   (circle one)
        Time you were called into the office the second time. _____
        Time you left the office the second time. _____

10. If you were first seen by a physician assistant or nurse practitioner and
    then referred to a doctor:
        Time you went into the doctor's office. _____
        Time you left the doctor's office. _____

QUESTIONNAIRE B   P   A

1. Were you seen by a:

        doctor   physician assistant   nurse practitioner (circle one)

2. How long did you have to wait before you were seen? (circle one)

    0-5 min   6-10 min   11-15 min   16-20 min   21-30 min

    31-45 min   more than 45 min

3. Did you feel that the waiting time was: (circle one)

    too long   long but reasonable under the circumstances   reasonable

4. How do you feel about the following aspects of this hospital? Place
    an X in the appropriate column.

	Excellent	Good	Average	Fair	Poor
a. The overall service	___	___	___	___	___
b. The service you received today	___	___	___	___	___
c. The physicians	___	___	___	___	___
d. The nurses	___	___	___	___	___
e. The physician assistants	___	___	___	___	___
f. The medical technicians	___	___	___	___	___
g. The appointment system	___	___	___	___	___

5. What do you like the most about this hospital?

6. What do you like the least about this hospital?

7. What suggestions do you have to improve the service at this hospital?

BIOGRAPHICAL SKETCH

John Wallace Koch was born in Akron, Ohio, on December 2, 1949.
He received his elementary education in the Parma, Ohio, public schools.
Although his secondary education began in this same system, it was
completed at Cross Keys High School in Atlanta, Georgia. In 1967 he
entered the United States Air Force Academy in Colorado Springs,
Colorado, and graduated with a Bachelor of Science degree in
Engineering Mechanics in 1971. After being commissioned as a
Second Lieutenant in the United States Air Force, he attended
undergraduate pilot training, and subsequently served as a pilot in
the Air Force from 1972 to 1978. As a Captain in the Air Force, his
graduate education began in 1978 when he entered the Graduate College
at Arizona State University in Tempe, Arizona, in the field of
Industrial Engineering. He is a member of Alpha Pi Mu, the Industrial
Engineering honor society. He married Sandra Lee Michalek of Seven
Hills, Ohio, in 1971, and is the father of three children, Jennifer,
Nathan, and Ryan.